



# INVENTORY OF RESEARCH PROJECTS 1974 -75

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1975



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PREFACE

Thanks are expressed to those who contributed to the production of this research inventory, in particular Lena Galati, Sharon Earn, and Don Robinson who co-ordinated the work of the group. The assistance of Dr. Peter Victor, who was responsible for the production of the original inventory, was much appreciated.

Any questions concerning specific projects should be addressed to the Director of the Branch which initiated the study.

  
Gerard C. Ronan  
Director, Laboratory Services Branch

## INVENTORY OF RESEARCH PROJECTS

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## INTRODUCTION

### ORIGIN OF THE PROJECT

In June 1973, the Strategic Planning Branch commenced the preparation of this inventory of the research and development being conducted by this Ministry. The project was initiated in response to a growing need, recognized by the Deputy Minister, for a comprehensive list of research and development projects which would be readily available to all agencies engaged in environmental research, both within and outside the Ontario Government.

The project was completed in January, 1974. Responsibility for revising and updating the inventory was undertaken by the Laboratory Services Branch in January, 1975.



PURPOSE

The purpose of this report is to promote the communication of this Ministry's activities to the research community, and to facilitate a more efficient use of capital and human resources devoted to environmental research. It is hoped that the information contained here will assist those currently conducting studies, by providing them with access to projects in this Ministry which are related to their own. Another major objective is to foster co-operative efforts and prevent the duplication of programs, particularly among Ministries of the Ontario Government. Ultimately, the inventory and successive updates will provide a comprehensive background for the selection of environmental research priorities, revealing those areas which are already being extensively examined, and those which demand increased attention.

### ORGANIZATION OF THE INVENTORY

The report consists of profiles of all the individual research projects being conducted by each Branch of the Ministry in the (1974-75) fiscal year, as they were identified by the Branches themselves. It includes in-house activity, as well as grants to Universities and contract research.

Since a dictionary definition research - "investigation aimed at the discovery of facts or principles" - is so general as to include some elements of almost every operation of this Ministry, certain limits were established to the terms of reference of this report. The inventory includes:

- (1) all projects conducted outside the Ministry, through Ministry of the Environment funding;
- (2) all projects of the Research and Laboratory Branches

- (3) any in-house activity which involves fundamental research;
- (4) major regional studies, pilot programs, and experimentation with new technological or administrative approaches to established operations.

It is outside the objectives of the inventory to include the routine test series and studies which implement on-going management programs. To distinguish those in-house projects with a significant innovative element is often difficult; however, for the purposes of this report the decisive factor is that the Branch conducting a project considers it constitutes part of its research activity.

#### EXPLANATION OF TABLES

The statistical tables found at the end of this Introduction are drawn directly from the information presented in the profiles. Figures are broken down by Branch, and aggregated to reflect the Ministry

activity as a whole. Where separate projects are grouped as a set in the report, but distinct budgets and durations are supplied, each component is identified separately in the computations. Budgets and durations are tabulated as the information was received; however, because of the absence in the Ministry of any standard system of identifying and accounting for resources devoted to research, statistics derived from these profiles can only claim to demonstrate the general direction and contours of the program.

TABLE 1

Table I gives the total number of research projects reported for each Branch. This total is broken down to demonstrate the way in which each Branch employs the funds it allocates to research. Approximately 75% of the projects are conducted in-house; the majority of those remaining are grants to Universities. There is, however, a wide disparity among the Branches; only two utilize contract or research

grant programs.

The column entitled "Public Response Factor" is included to point out the number of projects which explicitly study the public reaction to the experimental program in question. These represent a little less than 1% of the total. Table 1 also indicates that, overall, about 21% of the projects involve some co-operation with other Ontario Ministries, Federal Government Agencies, municipalities, etc. In some cases the effort is a joint under-taking throughout; in others, the co-operating agency contributed samples, or facilities, to a Ministry of the Environment project.

#### TABLE 11

Table 11 refers to the expected duration periods of the projects.

Twenty-one percent of the projects are expected to last for a period less than one year and 13% have an expected duration of one to three years. Twenty-seven percent are open-ended and 18% are of uncertain duration. Only 8% of the projects extend over a period

TABLE 111

Table 111 reflects the research budgets of the various Branches in 1974-75, and shows whether funds are concentrated on a few major projects, or divided among many smaller ones. In some cases, the project necessitated purchase of capital equipment; this expenditure is included in determining the project value. Where projects were valued in terms of man-months, a conversion factor of \$1,250 per man-month was applied. The totals represent the sum of dollar figure budgets and those converted from valuations in man-months. Thirty-two percent of the budgets were not ascertained; this fact influences the significance of conclusions drawn from the aggregate figures. If, however, the unascertained projects are consistent with those which are valued, about 61 percent require \$10,000 or less, another 29% from \$10,000 to \$50,000 and 10% exceed \$50,000 in budget.

FORMAT

Projects are grouped under their funding Branches. The profiles supply the following information:

- Objective            Immediate reasons for embarking on the project often includes, implicitly or expressly, indications of how these immediate objects contribute to long-term policy intention.
- Description        Details of the projects - its phases, focuses, the methodology employed - expressed so as to indicate the exact nature of the research to persons with expertise in the field. Where a set of projects have been grouped under one title, the individual projects receive separate treatment under the "Description" heading, and thereafter.
- Duration            Usually starting date and actual or projected completion date. When only a fiscal year period is indicated, the duration is uncertain, but is less than a year; and the project was begun and completed within that fiscal year. Where a project has several phases, their durations are presented separately.
- Site                Particular location of experimental activity, if specified.

Commentary

How the research is performed and funded. If in-house, by what Branch? With co-operation from any other agency? Is it a component of some larger study?

If by contract or grant, identification of the firm, or University (and principal investigator) receiving the funds. If there are special funding mechanisms (for instance, the Canada-Ontario Agreement on the Lower Lakes), they are noted.

Include under Description

Budget

(a) Dollars

An estimate, either in terms of time expended, or dollar figures, of the cost of the project for 1974-75. If the project extended beyond the current fiscal year, it is indicated whether the figure represents total project value, or the portion spent in 1974/75. In some cases, expenditure in previous years is supplied. The figures are not precise, except where they represent a grant or contract disbursement. They are intended to indicate the relative magnitude of the project.

(b) Man hours

(c) Source of funds  
(d) Branch budget  
(e) ~~Fiscal year~~

Report

Whether there will be interim and/or final reports available; and when anticipated

Supervision

The contact person in the Branch, from whom further details may be obtained.

not Principal Investigator

Date

In some instances, not all this information was available. In particular, budget allotments for in-house activities were difficult to isolate.

The report is constructed so as to be capable of periodic update by removal and insertion of pages.



TABLE 1TOTAL  
NUMBER  
OF  
PROJECTS

How Research Funds Employed

In-House

Grant  
to Uni-  
versity

Contract

Other

PUBLIC  
RESPONSE  
FACTORxxvi  
COOPERATION  
OUTSIDE  
AGENCIESENVIRONMENTAL  
APPROVALS

2

2

2

WATER  
RESOURCES

31

27

1

1

13

POLLUTION  
CONTROL

84

53

17

4

4

28

AIR  
RESOURCES

36

7

15

1

4

5

LABORATORY  
SERVICES

98

96

2

TOTAL

251

185

32

5

9

1

50

TABLE 2

## DURATION

## BRANCH

*6 months  
and under**over 6 months  
to 1 year**over 1 year  
to 3 years**over 3 years  
to 5 years**over 5 years**open-ended**uncertain**complete*ENVIRONMENTAL  
APPROVALS

1

1

WATER  
RESOURCES

2

1

4

3

17

4

POLLUTION  
CONTROL

11

2

7

8

2

24

9

12

AIR  
RESOURCES

1

10

4

12

7

LABORATORY  
SERVICES

30

7

2

1

29

19

10

TOTAL

43

11

23

16

2

70

45

30

TABLE 3

BUDGET  
1973/74

BRANCH

\$10,000  
and underOver \$10,000  
to \$20,000Over \$20,000  
to \$30,000Over \$30,000  
to \$50,000Over \$50,000  
to \$100,000Over \$100,000  
to \$200,000

Over \$200,000

Not  
Ascertainedxxviii  
TOTAL  
AscertainedENVIRONMENTAL  
APPROVALS

1

WATER  
RESOURCES

8

2

2

5

2

1

2

9

22

POLLUTION  
CONTROL

17

9

7

5

1

4

5

24

48

AIR  
RESOURCES

1

28

1

LABORATORY  
SERVICES

65

5

3

4

3

77

TOTAL

90

17

12

14

3

5

7

65

148

# Environmental Approvals Branch

ALTERNATIVE POLICIES FOR POLLUTION ABATEMENT IN THE ONTARIO PULP AND PAPER INDUSTRY

---

Objective        To assess alternative policies for pollution abatement in the Ontario pulp and paper industry.

Description     Define and quantify the consequences of alternative pollution abatement policies for the pulp and paper industry in Ontario. Examine the effects of different environmental objectives on these consequences.

Duration        Commenced October, 1973; Report completed 1974

Commentary      An in-house project of the Environmental Approvals Branch with the cooperation of the Industrial Wastes, Water Quality and Sanitary Engineering Branches of the Ministry of the Environment, and of the Ministries of Treasury, Economics and Intergovernmental Affairs, and Industry and Tourism. Consultation is expected with the Ministry of Natural Resources. (Specific Budgetary Program - Administration: Environmental Approvals Branch).

Budget            (One Economist 4, 75% of time)

Report            Interim proposal-progress report for internal use; final report to be prepared when project completed.

Supervision      Dr. J. Donnan, Economist

AN ECONOMIC AND ENVIRONMENTAL MODEL FOR PLANNING AND FORECASTING

Objective To establish an empirical model to forecast medium and long-term environmental problems, and to facilitate the analysis of policies which are intended to deal with them.

Description In conjunction with the Econometrics Branch at T.E.I.G.A., the existing input-output model for Ontario will be adapted to account for inputs from the environment to the economy, and outputs from the economy to the environment. Forecasts of provincial economic growth will be used to generate forecasts of the environmental inputs and outputs associated with the growth. The effects of these future environmental inputs and outputs on the air, land, and water quality of the province will then be capable of analysis and evaluation.

Duration Uncertain

Commentary An in-house project of the Environmental Approvals Branch facilitated by consultation with the Ministry of Treasury, Economics and Intergovernmental Affairs. (Specific Budgetary Program - Administration: Environmental Approvals Branch).

Budget Pilot stage - one student, 75%, of time; economist 4, 25% of time. Second stage - not yet ascertained.

Report Preliminary written report - April 1974; second stage report - September, 1975.

Supervision Dr. P.A. Victor, Economist

# Water Resources Branch

ASSESSMENT OF GROUND WATER INFLOW TO LAKE ONTARIO

Objective To contribute hydrogeological information on the terrestrial balance component of the International Field Year for the Great Lakes program (IFYGL) (some of the other aspects were "lake balance" and "energy balance").

Description Utilizing data obtained from hydrogeologic studies of seven representative areas in the Lake Ontario water basin, the program assessed the total ground-water inflow from the Province of Lake Ontario, to Lake Ontario.

Duration April 1972 to April 1973 (data Collection); to 1974 - Interpretation of data.

Commentary An in-house research project by the Water Resources Branch; Hydrology & Monitoring Section.

Budget \$43,100 (total program value)

Report To be published in component form by Branch during 1974/75. Full IFYGL report in 1975.

Supervision R. C. Hore, Supervisor



GEOPHYSICAL STUDIES

Objective        To improve techniques for ground water resource assessment, using geophysical techniques.

Description     Geophysical techniques using seismic, resistivity, magnetic and well-logging methods are being employed and tested to aid in the assessment of the Province's ground-water resources.

Duration        Open-ended

Commentary     An in-house research project by the Water Resources Branch; Hydrology & Monitoring Section.

Budget           \$39,000 (1973/74). Only a small proportion is actually devoted to the research aspects of the program.

Report           Most components completed as work units for other studies; however, some specialized formal reports are pending.

Supervision     R. C. Hore, Supervisor

GROUND WATER POLLUTION STUDIES

Objective      To improve expertise in predicting the migration of ground-water contaminants, as a supplement to consultative activities involving the Pollution Control Planning and Environmental Approvals Branches, and the Regions in the Regional Operations Division.

Description      Involves monitoring chemical contaminants primarily.

Duration          Open-ended

Commentary      An in-house research project by the Water Resources Branch; Hydrology & Monitoring Section. Ties in with related studies contracted to the University of Waterloo under the terms of the Canada-Ontario Agreement and to those of the IJC - Pollution from Land Use Activities Reference Group.

Budget

Report            Final reports available for specific aspects of the study.

Supervision      R. C. Hore, Supervisor

REPRESENTATIVE BASIN STUDIES

Objective        The estimation and identification of hydrologic index parameters for the evaluation of all phases of the hydrologic cycle as it applies to five selected representative drainage basins, typical of various geologic and physiographic regions in Southern Ontario.

Description     Collection, analyses and interpretation of hydrologic data for general water balance studies; the formation of a computerized hydrologic information system and data base for continuing development and calibration of mathematical hydrologic models; establishing physically based functional and empirical relationships between interrelated hydrologic and/or hydrogeologic processes for extrapolation to other similar hydrologic areas in Southern Ontario.

Duration        International Hydrologic Decade Program (IHD) 1965-74.

Commentary     The research project is an on-going program of hydrologic and hydrogeologic investigations under the auspices of the IHD program (MOE contribution). The active data collection program is scheduled to be completed at the end of 1974; but it is anticipated that some of the aspects of the research project will be continued under the pending successor program, International Hydrologic Program (IHP). Studies are being carried out in conjunction with the development of hydrologic models.

Budget            1974/75 approx. \$40,000.

Report            End of 1975.

Supervision      F. C. Fleischer, Water Modelling Section, Water Resources Branch.

CHLOROPHYLL-SECCHI DISC SELF-HELP PROGRAMME, RECREATIONAL LAKES

Objective        To evaluate over a long term (several years) the status of enrichment as indicated by measurements of suspended algae and water clarity in recreational lakes in the province.

Description     Programme involves extensive co-operation and communication with concerned members of cottagers associations, permanent lake-side residents and provincial government agencies who agree to collect water samples for chlorophyll a analysis and measure water clarity at regular intervals throughout the summer.

Duration        May-November, annually; program commenced 1971.

Commentary     An in-house project of the Water Resources Branch with the co-operation of the Laboratory (Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity).

Report            1973 reports by 1974

Budget            4 man-months/annum

Supervision     G. Robinson

DEVELOPMENT OF A WATER QUALITY GUIDELINE FOR SULPHATE

Objective            To establish a maximum acceptable concentration for sulphate which will assure the maintenance of a healthy aquatic fauna - particularly in soft pre-Cambrian waters subject to high sulphate loadings from mining and milling operation.

Description        Investigation of the chronic effects of high sulphate concentrations (250-4000 mg/l) on fish and invertebrate organisms. Both field and laboratory studies are involved. Organisms studied include rainbow trout, smallmouth bass; north littoral and burrowing mayfly nymphs; amphipods and cladocerans; clams. Responses study - lethality to invertebrates; lethality, growth, O<sub>2</sub> uptake and hematocrits for fish.

Duration            June 1972 to June 1974

Commentary        An in-house project of the Water Resources Branch at the request of Industrial Wastes, and with the co-operation of the Laboratory Services Branch (Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity).

Budget              Approximately 20 man-months.

Report              Expected fall 1974; technical report

HARBOUR MODELLING STUDIES

<u>Objective</u>	Develop a three-dimensional, field validated predictive water quality model which will consider changes in shoreline geometry and discharges.
<u>Description</u>	Operating recording water chemistry and physics meters, evolving computer numerical models to utilize and process the data. Models will be applied to Hamilton harbour and Toronto harbour.
<u>Duration</u>	1974-75 and 1975-76
<u>Commentary</u>	An in-house project of the Water Resources Branch.
<u>Budget</u>	24 man-months
<u>Report</u>	Hamilton Harbour - 1975
<u>Supervision</u>	M. D. Palmer, Water Modelling Section, Water Resources Branch.

INFORMATION SEARCH - EFFECTS OF RECREATIONAL LAND USE ON LAKE WATER QUALITY

Objective            To document effects of recreational land use on water quality within the Great Lakes and determine the "State of the Art" with respect to present management and legislation.

Description        The project is a literature research function the main thrust of which is to outline the water quality implication of cottage and parkland development with respect to nutrient enrichment, bacterial contamination and solid waste disposal problems.

Duration            July to November, 1973

Commentary        An in-house project of the Water Quality Branch at the request of the Great Lakes Water Quality Board. A certain amount of liaison with other Government agencies will be necessary for a proper and complete evaluation of the existing situation. (Specific Budgetary Program - Water Resources; Limnology & Toxicity).

Budget              4 man-months

Report              Report completion date: November, 1973, detailed report

Supervision        K. H. Nicholls

KAWARTHA LAKES MANAGEMENT STUDY: LAKE ENHANCEMENT

Objective Investigation and implementation of techniques for enhancing recreational lakes which have deteriorated because of excessive aquatic enrichment; development of sound water and fish management plans.

Description A set of projects including:

- (a) Air-induced destratification of water (Projects #86(a) and (b) )
- (b) Chemical precipitation of contaminants (Projects #88, 89)
- (c) "Operation Weed Removal" - mechanical harvesting of weeds, assessment of impact of the removal on the fisheries, plant populations, and water quality of Chemong Lake. (Project #82)
- (d) Investigation of remote sensing techniques for establishing, mapping, and speciating standing crops of aquatic vegetation, by color and infrared aerial photography. (Project #83)
- (e) Documentation of restoration effects on lakes of phosphorus removal in sewage treatment process. (Project #83)

Duration Overall study period is 1971 to 1975; for duration of specific component projects, see "1973-74 Field Project Summary Sheets, Water Resources Branch."

Commentary "Operation Weed Removal" is a joint M.O.E.-M.N.R. program; the other components are in-house projects of the Water Quality Branch, with some assistance from the C.C.I.W., and C.C.R.S. (Specific Budgetary Program - Water Resources: Water Quality; Limnology & Toxicity ).

Budget

- (a) 27 man-months total;
- (b) 16 man-months total;
- (c) 32 man-months in 1972/73, \$160,000 data processing contract;



(d) 10 man-months

Reports

- (a) Final report, 1975;
- (b) Interim, 1973/74;
- (c) Final report after 1975;
- (d) 1974;
- (e) 1974/75.

Supervision

I. Wile, K. Nicholls, M. Palmer.

LAND DRAINAGE REFERENCE (IJC) - WATER QUALITY ASSESSMENT, PILOT  
WATERSHED STUDIES

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Objective            To determine the significance and magnitude of all existing or potential non-point sources of pollution in the Great Lakes Basin (eg - agricultural activities, solid waste disposal, municipal storm drainage).

Description        After conducting a review of existing information the subject, and comprehensively categorizing land uses in the focal regions, pilot watershed studies will (1) measure the significance and magnitude of potential pollution from transportation corridors and construction projects; (2) relate all sources of pollution to water quality and materials input. Based on the findings, projections of conditions in the Lower Lakes will be made for the years 1980, and 2020. Another phase of the Reference will be to evaluate existing water quality in the Lower Lakes.

Duration            Commenced 1973; on-going for an indefinite time.

Commentary        An in-house research project of the Water Resources Branch. The investigation represents input from the Branch to a major co-operative research program of the Federal Government, American IJC authorities, related Ministries, and other Branches of the Ministry of the Environment. (Specific Budgetary Program - Water Resources: Water Quality; Limnology & Toxicity).

Report              IJC Report will be issued.

Budget              Not determined.

Supervision        J. Ralston

MERCURY PROGRAM

Objective        To maintain surveillance on, and expand information about, the distribution and movement of mercury in waters, sediments, and biota in the (a) St. Clair, and (b) English River systems (separate projects).

Description        (a) Regular sampling of water and sediments in both St. Clair River, and Lake St. Clair; mercury and methyl mercury presence determined in food chain organisms; degree of contamination in sport and commercial fish assessed (Project #59, #73)

                          (b) Sediment sampling, and study of transportation through resuspension.

Duration            (a) May - October, 1973;  
                          (b) August 1973, Spring 1974.

Commentary        A set on in-house projects of the Water Resources Branch, supported by the Laboratory Branch, and with the cooperation of the Ministry of Natural Resources in fish sampling. (Specific Budgetary Program - Water Resources: Water Quality; Surveys and Limnology & Toxicity).

Budget              (a) 27 man-months total;    (b) 1½ man-months.

Report              (a) Monitoring reports twice yearly; report on fish contamination, January 1974;    (b) Report by memo (internal).

Supervision        (a) O. Moore, (b) S. Irwin.

MUSKOKA LAKES STUDY

Objective            To assess occurrence and relative severity of water quality problems throughout this recreational lakes region.

Description        Three phases: (a) a survey questionnaire to identify observations and primary concerns of lake residents and cottagers;  
(b) a study of effects of DDT on fish populations with continuing sampling of fish, clams and sediments to ascertain the rate of decline of DDT levels, and the restoration of capacity to reproduce, and to be consumed safely;  
(c) examination of aquatic enrichment effects.

Duration            Commenced 1970; monitoring to continue indefinitely.

Commentary        An in-house research project of the Water Resources Branch in cooperation with the Laboratory Branch, and with the support of the Ministry of Natural Resources. (Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity).

Budget              Three staff members, full time, per annum.

Report              Completed on phases (a) and (c); annual technical reports on decline of DDT.

Supervision        Dr. T. G. Brydges, Manager, Limnology & Toxicity.

RECREATIONAL LAKES NUTRIENT BUDGETS

Objective            To estimate contribution of nutrients to four Precambrian Lakes in runoff from forested land, marsh drainage and cottage waste disposal systems and to evaluate the relative importance of each major contribution. Other minor seasonal sources and sinks are being evaluated. It is expected that artificial nutrient sources will be eliminated in 1974-1975 and effects above assessed.

Description        Gauging of inflowing and outflowing streams, regular water quality monitoring. Measurements of primary production, nutrient regeneration and particulate sedimentation, employing specialized equipment.

<u>Duration</u>	May 1973 to December 1974	<u>Site</u>	Harp Lake, Gerry Lake (Huntsville area); McLean Lake (Severn system); Riley Lake.
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Commentary        An in-house research project of the Water Resources Branch.  
(Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity).

Budget                15 man-months

Report                September 1975

Supervision        K. H. Nicholls

ST. CLAIR RIVER PLUME STUDY

Objective            To develop a mathematical relationship for the dilution of a conservative input from a shoreline discharge.

Description        The input source for the study consists of two Dow Chemical Company outfalls which contribute more than 90% of the chloride load to the river. Existing data from range monitoring programs and additional sampling of the outfalls and the area immediately downstream will be used to trace the chloride concentration both downstream and out from shore.

Duration            May to November 1973

Commentary        An in-house project of the Water Resources Branch at the request of Industrial Wastes (Specific Budgetary Program - Water Management: Water Resources; Water Quality Surveys).

Budget              3 man-months

Report              Memorandum of November 30, 1973.

Supervision        J. D. Kinkead

SUDBURY PROGRAM - WATER QUALITY

Objective            To develop, through a set of research projects, a comprehensive analysis of the environmental conditions existing in the Sudbury region, and experiment with remedial techniques.

Description        (a) Intensive monitoring of primary productivity and standing crops, primary and secondary trophic levels.  
(b) Extensive monitoring - methodology development.  
(c) Sulphate standards development.  
(d) Toxicity evaluations for fish.  
(e) Lake reclamation by addition of buffering agents to combat acidity.

Duration            Commenced 1973/74; 3 to 4 year span in all.

Commentary        An in-house research project of the Water Resources Branch. The study, designed by the Sudbury Environmental Task Force, involves coordinated efforts of the Air Resources Branch, other related branches of the M.O.E., and the Ministry of Natural Resources. (Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity and Surveys Sections).

Budget              36 man-months to September, 1973.

Report              Detailed, and interim reports completed for 1973/74; final report expected in 1975/76.

Supervision        Nels Conroy, B. Fallis.

TOXICITY STUDIES IN FISH

Objective           The four separate projects are directed toward improving methodology for measuring toxic effects on fish, and determining responses to particular substances.

Description       (a) Development of laboratory capacity to detect sub-lethal toxicant activity by monitoring fish respiration electronically (Project #75)  
(b) To culture four bioassay test species of fish, for egg-to-egg or partial life-cycle toxicity testing (Project #77)  
(c) To determine significance of ammonia from refinery effluents in producing acute toxicity in fish (Project #71)  
(d) Application and evaluation of seven broad-spectrum antibiotics on five species of telcostean fish commonly used in bioassays (Project #79)

Duration           (a) March-December, 1973; (b) 1973-1975 (2 years); (c) June-October, 1973; (d) 1973-1974.

Commentary       In-house projects of the Water Resources Branch, generated either internally or by Industrial Wastes (Specific Budgetary Program - Water Management: Water Resources; Limnology & Toxicity).

Budget             Regular staff, 50 man-months total

Report            (a) February 1974; (b) 1975; (c) Spring, 1974; (d) Fall, 1974.

Supervision       C. Inniss, D. L. Wells



UPPER LAKES REFERENCE (IJC)

Objective            A group of projects aimed at assessing present water quality in the Upper Great Lakes, and establishing baselines for assessing the effects of various pollutant emissions and water uses on phytoplankton and fish communities. The study will examine trans-boundary movement of pollutants, and the effects of various industrial and municipal discharges on water quality.

Description            (a) Determination of trans-boundary movement of pollutants in the St. Mary's River (Project #63)  
(b) Near shore water quality monitoring; establishment of baseline for measuring effects of further shoreline development (Project #64)  
(c) Phytoplankton monitoring; to determine current abundance, diversity and adaptability of communities (Project #65)  
(d) Peninsula Harbour Study; sampling over a grid for mercury and organic content of sediments. Special attention to effluent plume from the adjacent pulp and paper mill (Project #66)  
(e) Jackfish Bay Study; effects of pulp and paper mill discharge (Project #67)  
(f) Block Bay study; sampling of water, sediments and benthic communities at various depths to determine baseline characteristics for an undeveloped bay (Project #68)  
(g) Thunder Bay Study; comprehensive examination of quality factors (Project #69)  
(h) Near Shore Fisheries assessment; establishment of baseline data on presence of contaminants, esp. mercury, PCB's, DDT, dieldrin, in four species of fish (Project #101)

Duration            Most projects to be completed by end of 1974; for particulars, see "1973-74 Field Project Summary Sheets, Water Resources Branch."

Commentary            An in-house program of the Water Resources Branch, contributing along with other IJC authorities toward the overall study. (Specific Budgetary Program-Water Management: Water Resources; Limnology & Toxicity and Surveys Sections).

Report            File reports for most projects; all reports to be included in final Upper Lakes Reference to be issued by IJC.

GREAT LAKES WATER QUALITY MODELLING

Objective            To define processes in the near shore lake regions such as eutrophication and sedimentation and some lakewide models, for Lakes Superior, Huron, and Ontario.

Description        Data from conventional water quality surveys is combined with some recording meter data and used in a model to determine the mass exchange between coastal and offshore waters.

Duration            On-going

Commentary        An in-house project of the Water Resources Branch (Specific Budgetary Program - Environmental Assessment and Planning; Water Resources; Water Modelling.

Budget              6 man-months

Report              Annual, and project

Supervision        M. D. Palmer, Water Modelling Section, Water Resources Branch.

DEVELOPMENT OF DISSOLVED OXYGEN STREAM MODELS

Objective            To develop new and improve existing dissolved oxygen stream models, used for evaluating the effect of various water management alternatives on water quality. Models are presently used to set waste loading levels in Ontario streams which allow dissolved oxygen criteria to be met and to indicate waste effluent releases with respect to variations in natural or augmented streamflow.

Description        Models are two types: (a) Steady state and (b) dynamic simulation.  
(a) Steady state models will be applied routinely by regional staff to point source waste loading locations.  
(b) The dynamic simulation model was developed as part of the Thames River Study. Research will continue to (a) improve sub-models describing inputs, (b) develop interface with other models such as hydrologic models, storm water management models and ecologic models and (c) to include additional water quality parameters.

Duration            Continuing studies; modelling for the Thames River Study to be complete by the end of 1974, other water quality modelling studies commencing (e.g. Grand River) fall 1974.

Commentary        Routine steady state modelling funded by in-house budgets. Dynamic simulation was funded in the past by combinations of in-house and special budgets for the Thames River Study. Future budgeting will come from in-house and special budget for river basin studies such as the Grand River Study.

Budget              1974/75 approx. \$45,000 (Thames R. budget); in-house approx. \$20,000.

Report              "Water Quality Modelling for the Thames River Study" due late 1974.  
Other technical reports and papers planned for 1975.

Supervision        D. G. Weatherbe, Water Modelling Section.

DRAINAGE BASIN STUDIES

Objective            To participate in the development of a uniform approach to hydrologic studies across the province, carry out specialized drainage basin studies where necessary and provide expert guidance to the Regions in the undertaking of their studies.

Description        Drainage basin studies determine the quantity of the water resource available for existing and potential utilization, define the existing and potential environmental stresses on surface and groundwater quantity and quality, and provide basic quantity management guidelines to aid in resource development.

Duration            Open-ended.

Commentary        An in-house project by the Water Resources Branch, Hydrology & Monitoring Section, and the Technical Support Branches in the Regions.

Budget              For Water Resources Branch only in 1974-75, \$141,000.

Report              Water Resource of the Duffin-Rouge Study Area, under preparation for publication during 1975.

Supervision        R. C. Hore, Supervisor

REMOTE SENSING TECHNIQUES

Objective To carry out the development and evaluation of remote sensing techniques as applied to geology, hydrology and hydrogeology and provide expert guidance in the use of remote sensing techniques.

Description ERTS-1 Satellite, and other high altitude imagery allows in pictorial format a view of regional areas of the earth surface. By processing the imagery, various data on land use, geology, soils, hydrology, hydrogeology, sediment, etc. can be obtained and used to provide information to ongoing studies on these earth sciences in the province. As part of these studies the feasibility of using data from gamma attenuation surveys are being assessed as they relate to snow pack depth and soil moisture.

Duration Open-ended

Commentary An in-house project by staff of the Hydrology and Monitoring Section, Water Resources Branch, in conjunction with the Ontario Centre for Remote Sensing (OCRS), the federal Department of the Environment, McMaster and Guelph Universities.

Budget \$40,000 - Hydrology & Monitoring Section only.

Report Component reports will be available as study progresses.

Supervision R. C. Hore, Supervisor.

POLLUTION FROM LAND USE ACTIVITIES

Objective            To assess the effects of pollutants from non-point source discharges on the Great Lakes water quality from the various land use activities as part of the International Joint Commission (IJC) - (PLUARG) Task C study - Pollution from Land Use Activities Reference Group.

Description        Intensive study of a small number of representative watersheds, selected and conducted to permit some extrapolation of data to the entire Great Lakes basin and to relate contamination of water quality, which may be found at river mouths on the Great Lakes, to specific land uses and practices such as those found in agricultural watersheds, in forested watersheds, in connection with urban land development and use and through riverbank erosion.

Duration            To the end of 1977.

Commentary        An inter-agency project by the Ministries of Environment, Natural Resources, Agriculture and Food, Canada Department of Agriculture and contracts with various universities. A large portion of the Ministry of Environment's contribution is being carried out in the Hydrology & Monitoring Section, Water Resources Branch.

Budget              Water Resources Branch only for 1974-75 budget year is \$205,000.

Report               1978.

Supervision        R. C. Hore, Supervisor, Hydrology & Monitoring Section.

PHYTOPLANKTON - NUTRIENT RELATIONSHIPS ON ONTARIO SURFACE WATERS

Objective        To establish suitable criteria for nutrient levels in treated sewage effluent as they affect algae growth in both hard and soft surface waters.

Description     Preliminary limnological assessment of natural nutrient-phytoplankton relationships in waters of various trophic classes are being examined. Controlled laboratory and field algal assays were then initiated to clarify interrelationships between phytoplankton responses and the availability of various major and trace nutrient materials typically associated with sewage effluents.

Duration         From 1967: open-ended

Commentary       An in-house research project of the Water Resources Branch.  
(Specific Budgetary Program - Water Resources; Limnology & Toxicity;  
Special Studies)

Budget

Report

Supervision      K. Nicholls, Limnology & Toxicity

WATER TREATMENT PROBLEMS OF ALGAL ORIGIN

Objective            To assist in resolution of water treatment problems with respect to taste, odour and filter-clogging associated with algae.

Description        To provide a support function within the Research Branch to engineers involved in water treatment research, by identifying algae and supplying cultures of selected phytoplankton to assist in the development of treatment methods for the removal of taste, odour and filter-clogging problems of water treatment.

Duration            From 1965, open-ended

Commentary        An in-house research project of the Water Resources Branch.  
Limnology & Toxicity.

Budget              \$1,000 or less per annum

Report              No

Supervision        Dr. K. Nicholls



## WATER QUALITY ASSESSMENT - LOWER GREAT LAKES AND INTERCONNECTING CHANNELS

Objective Continuing assessment of water quality in the Interconnecting channels and lakes Erie and Ontario to examine water quality trends to provide information on use, suitability and to determine for and response to abatement programs.

### Description

- a. Surveillance will be carried out in co-operation with federal and state agencies in the St. Clair River, Lake St. Clair, Detroit River, Lake Erie, Niagara River, Lake Ontario and the St. Lawrence River. The emphasis in sampling programs will be on the St. Clair River and nearshore area of Lake Erie with less frequent sampling of the other waters to provide a check on findings of other agencies.
- b. Metro Toronto Waterfront - assist MTRCA in establishing a monitoring program to assess effects of landfill on water quality and conduct own monitoring of selected stations to supplement and verify their observations. Complete reports in preparation on water quality trends in the St. Clair River and Bay of Quinte.
- c. Intensive assessments of localized areas which have been subject to increased or decreased waste loading to update earlier observations.

Duration Surveillance will be a continuing program. Intensive surveys of local areas will be of short duration and will be completed during the 1975 survey season.

Commentary       Surveillance activities are a co-operative effort with federal and state agencies as part of an international program involving the requirements of the Canada-U.S. Agreement, as well as a Water Resources Branch program providing basic information for developing MOE water quality management policy and programs. Intensive surveys result from requests by regional abatement staff on treatment requirements in problem areas.

Reports       Internal reports to abate-ment managers for program development and annual reports on surveillance findings will be prepared in co-operation with other agencies for the Water Quality Board (IJC).

DEVELOPMENT OF HYDROLOGIC MODELS

Objective To provide in-house expertise in the development and application of hydrologic mathematical simulation models and the advancement of hydrologic mathematical simulation models and the advancement of related mathematical methodologies for use as analytical aids or tools in the solution of management decision problems in water resources research and management projects.

Description Formulation, calibration or optimization, verification and general application of mathematical hydrologic models for elementary and complex watersheds by utilizing functional, operational or physically-based relationships for hydrologic processes.

Application of sensitivity and stochastic analysis and other applicable analytical techniques in the structural refinement of coarse hydrologic models.

Duration On-going activities by the Water Modelling Section

Commentary Initial developments and application of the hydrologic models will be relegated to the hydrologic research activities and computer information system of the MOE-IHD representative drainage basins. Model developments encompass: comprehensive watershed models and complementary component models such as snowmelt, precipitation, streamflow, soil moisture storage variation, evapotranspiration and groundwater flow, special studies dealing with streamflow data generation.

Budget 1974/75 approx. \$60,000.

Report Reports dealing with model application to IHD Representative Basin Studies - end of 1975.

Supervision F.C. Fleischer, Water Modelling Section, Water Resources Branch.

SOIL MOISTURE AND SNOW WATER EQUIVALENT MEASUREMENTS BY AIRBORNE NATURAL  
GAMMA-RAY ATTENUATION SPECTROMETRY

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Objective        To investigate the feasibility, applicability and relative accuracy of the measure of soil moisture changes and snow-water equivalent accumulation in drainage basins by the use of airborne natural gamma-ray attenuation spectrometry.

Description     The testing of theoretical relationships, establishment of correlation and empirical (calibration) relationships between natural gamma-ray attenuation spectrometric measurements taken by aircraft on prescribed flight lines and ground-truth measurements of soil moisture and/or snowpack water-equivalent taken by conventional destructive and gravimetric methods.

Duration        Ending March 1975

Commentary     This is a co-operate project with the Inland Waters Directorate, Glaciology Division, Canada Department of the Environment, Ottawa.

Budget           1974/75   \$10,000 (MOE):   IWD Approx. \$20,000

Report           Co-author report with IWD 1975

Supervision     L.A. Logan., Water Modelling Section,  
Water Resources Branch

EFFLUENT DISPERSION MODELS

Objective        To apply effluent dispersion models to specific problems areas. Models to be used for the following purposes:

- (a) Describe lateral and longitudinal mixing of effluents discharged in wide rivers.
- (b) Describe longitudinal mixing of highly variable effluent discharges in narrow rivers.
- (c) Describe dispersion of spills of toxic materials in river.

Description     Models described in literature and available as existing computer packages from external agencies, will be modified and applied to Ontario watersheds.

Duration        Presently (1974) development of concepts only. Computer simulation 1975.

Commentary     Studies form part of regular model development and application research by Water Modelling Section. General objectives are to adequately describe water quality conditions and changes in time and space for design of water management systems.

Budget            In-house funding; 1974 approx. \$5,000.

Report            As dictated by findings of study

Supervision     D.G. Weatherbe, Water Modelling Section

ECOLOGICAL MODELLING FOR RIVER SYSTEMS

Objective        To develop mathematical models to predict the effects of nutrient inputs on plant and algae growth in rivers and the resulting biomass buildup and effects on the dissolved oxygen regime.

Description     The model will be based on research study underway in the Limnology and Toxicity Section, Water Resources Branch, into nutrient-plant growth-dissolved oxygen interrelationships. The research study was started as part of the Thames River Study in 1972 and continues in the Limnology and Toxicity Section as an in-house project. Modelling effort will be initiated in late 1974.

Duration        Fall 1974 - continuing

Commentary     Funding from in-house staff allocations. Data-collection, techniques and formulation of relationships will come from studies by the Limnology and Toxicity Section. Computer costs to be borne by a combination of in-house and special allocations for basin studies. Present stages include concept development. Computer simulation work commencing 1975.

Budget         1974/75 Water Modelling: \$5,000; Limnology & Toxicity: field research costs.

Report          As dictated by results of study.

Supervision     D.G. Weatherbe, Water Modelling Section; L. Wong  
Limnology and Toxicity Section, Water Resources Branch.

PARAMETER MEASUREMENT TECHNIQUES FOR WATER QUALITY MODELS

Objective        To improve accuracy of models for prediction of dissolved oxygen relationships in rivers by development of direct measurement techniques for sensitive parameters.

Description     Atmospheric aeration and benthic respiration measurement techniques will be investigated, during drainage basin surveys.

Duration        Fall 1974 - continuing

Commentary     Work to be carried out by Water Modelling Section as part of research conducted to improve water quality modelling applications to field situations. Present stages include concept development. Field experiments to be conducted 1975.

Budget           1974/75 approx. \$5,000.

Report           As dictated by findings

Supervision     D.G. Weatherbe, Water Modelling Section

MODIFICATION AND IMPLEMENTATION OF STATISTICAL ANALYSIS PROGRAMS AND DEVELOPMENT  
OF PROGRAM INDEX LIBRARY FOR USE IN WATER QUANTITY AND QUALITY STUDIES

Objective        To prepare specific statistical analysis programs for use by Ministry of the Environment personnel in solving problems of qualitative and quantitative water resources. To develop a program library and index for ready reference and use by staff.

Description

- a) Descriptive statistics (mean, variance, standard deviation, maximum and minimum values, frequency, cumulative proportion, absolute proportion, etc.);
- b) Regression analysis (linear, stepwise and multiple regression, periodic regression and harmonic analysis, polynomial regression);
- c) Multivariate analysis (principle component analysis, factor analysis);
- d) Missing data correlation, and data filling programs;
- e) Synthetic data generation.

Duration        On-going studies by Water Modelling Section.

Commentary      Most hydrologic problems of water quality and quantity require the preparation of specific statistical programs to perform specialized operations dealing with the collection, organization, summarization, presentation and analysis of data.

Budget            Regular budget, 1974/75    Approx.    \$5,000.

Report            Program Library Index available 1975

Supervision      S. Singer, Water Modelling Section,  
Water Resources Branch



# Pollution Control Branch

EVALUATION AND ASSESSMENT OF SMALL AEROBIC SEWAGE DISPOSAL SYSTEMS

Objective            To evaluate newly-developed systems as presented by the manufacturers.

Description        Package sewage treatment units are being tested under supervision of Technical Services for about 12 months in order to evaluate efficiency of operation, quality of the effluent, servicing requirements for recommending or approving the system for installation in the Province.

Duration            Open-ended

Commentary        An in-House research project of the Pollution Control Branch. (Specific budgetary program- Pollution Control: Municipal & Private; Private Sewage).

Budget              \$5,000 per annum

Report              Interim report; access by consent of manufacturer.

Supervision        N.D. Pappas, Supervisor, Technical Services.  
N.A. Chowdhry, P. Eng. Sr. Development Engineer.

# FEASIBILITY STUDY OF HOLDING TANKS AND SEWAGE HAULAGE SYSTEM FOR INDIVIDUAL PREMISES

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Objective Investigation into the feasibility of a sewage holding tank and haulage system to service individual premises.

Description Existing and additional information collected from the Provincial agencies, equipment suppliers and from haulage contractors on the subject. Having defined the problem and the design criteria and the knowledge of equipment available alternative solutions have been proposed.

Duration Completed

Commentary A contract to James F. MacLaren Ltd, funded by the Pollution Control. (Specific budgetary program - Pollution Control: Municipal and Private, Private Sewage).

Budget \$42,000 (1972/73) \$20,000 (1973/74)

Report Report on Phase I published

Supervision N.D. Pappas, Supervisor, Technical Services

REMOVAL OF NUTRIENTS FROM TREATED DOMESTIC SEWAGE

Objective To adapt the application of different chemicals in septic tanks and in the tile field media, for removal of nutrients from treated sewage.

Description Different chemical additives will be introduced into septic tank systems in order to remove phosphorus from sewage.

Duration Projected 3-year duration (1973 - 1976)

Commentary An in-house research project of the Pollution Control Branch. (Specific budgetary program - Pollution Control: Municipal and Private: Private Sewage).

Budget \$15,000 (each of 1973/74, 1974/75, 1975/76)

Report To be prepared on completion. Interim reports if possible.

Supervision N.A. Chowdhry, P. Eng., Senior Development Engineer.  
Dr. M. Brandes, P. Eng., Development Engineer.

STUDIES ON SUB-SURFACE MOVEMENT OF EFFLUENT FROM SEPTIC TANK SEWAGE  
DISPOSAL SYSTEMS USING RADIOACTIVE AND DYE TRACERS

Objective To establish safe distances from receiving bodies (lakes, rivers, and streams), for location of private sewage disposal systems; data to be used in developing guidelines and standards for such systems.

Description Observation of sub-surface movement of traced septic tank effluent and testing of effluent for chemical and bacteriological quality before it reaches the receiving water body.

Duration Commenced 1972; open-ended      Site Chemong Lake (1972) Lake and Lake Couchiching areas (1973)

Commentary An in-house research project of the Pollution Control Branch. (Specific budgetary program - Pollution Control; Municipal & Private, Private Sewage).

Budget \$30,000 per annum

Report 1972 Interim report, Autumn 1973.

Supervision N.D. Pappas, Supervisor, Technical Services  
Dr. M. Brandes, P. Eng. Development Engineer

STUDY OF APPROPRIATE SOIL TYPES FOR REMOVAL OF BACTERIA AND NUTRIENTS IN  
RAISED BED (IMPORTED FILL) FILTRATION SYSTEMS

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Objective        To improve effectiveness of raised bed sewage filtration techniques, for application to topography to septic tank systems.

Description     Arrangements for raised filter beds and tile fields containing soils with and without chemical additives are being made. Field testing will be carried out in order to determine the removal of bacteria and nutrients from sewage.

Duration        Commenced 1973; to be completed 1976.

Commentary     An in-house research project of the Pollution Control Branch.  
(Specific budgetary program - Pollution Control.

Budget           \$10,000 (1973)   \$20,000 (1974/75)   \$20,000 (1975/76)

Report           Will be made when study completed Interim reports

Supervision     Dr. M. Brandes, P. Eng., Development Engineer  
Dr. H.T. Chan, P. Eng., Soils Engineer

UNDER-DRAINED FILTER BED SYSTEMS: WHITBY EXPERIMENTAL STATION

Objective        To Investigate the suitability of soils to be applied in the field treatment of domestic sewage

Description     Soils with different characteristics and with different chemical additives are applied for removing contaminants, bacteria and nutrients from sewage. The bacteriological and chemical properties of the septic tank effluent and of the final treated effluent are monitored periodically.

Duration        Commenced 1969; open-ended    Site   Whitby Experimental Station

Commentary     An in-house research project of the Pollution Control Branch.  
(Specific budgetary program - Pollution Control).

Budget           \$120,000 (since commencement)    \$50,000 per annum

Report           Interim report available in two parts

Supervision     N.A. Chowdhry, P. Eng., Senior Development Engineer  
Dr. M. Brandes, P. Eng., Development Engineer

APPLICATION OF SEWAGE SLUDGE TO MINE TAILING AREAS

Objective To explore the fundamentals of applying sewage sludge to tailings areas, for the purpose of inducing vegetation growth.

Description Program not finalized

Duration To commence 1973/74; duration Site INCO Tailings area, Sudbury  
uncertain

Commentary A research grant (pending) to Laurentian University, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control; Pollution Control; Solid Waste).

Budget \$10,000 (full project value - approximate)

Report None as yet

Supervision G.M. Wood, Planning Supervisor



AT-SOURCE NEWSPRINT SEGREGATION

Objective To compare effectiveness of various programs for encouraging homeowners to separate newsprint from other solid waste prior to collection.

Description Two operations are being experimented with:  
(1) Curb-side pickup on regular collection days  
(2) Curb-side pickup available on request with 24 hour notice

<u>Site</u>	(1) Brampton	<u>Duration</u> Commenced 1973-74; may be adopted as on-going program.
	(2) Lindsay	as on-going program

Commentary An in-house research project of the Pollution Control Branch. (Specific budgetary program - Air and Land Pollution Control: Pollution Control; Solid Waste).

Budget \$20,000 (approximately)

Report None as yet

Supervision G.M. Wood, Planning Supervisor

CREATIVE USES OF INDUSTRIAL WASTE

Objective        To develop designs for re-uses of industrial wastes prevalent in Toronto, and to explore the sources of capital and manpower to sustain the reclamation process as an independent commercial enterprise.

Description    A survey of Toronto industries (1200 questionnaires) yielded data on materials available; representative samples were collected. Student designs were collected for possible uses of the materials, and prototypes built. (Chairs, vinyl products, planters, etc.) Proposition - that materials be collected en masse, converted in Correctional institutions, and applied to government and private demands.

Duration        June to September, 1973.

Commentary     A research grant to the Student Enterprise Assistance League (SEAL) Funded by the Ministry of Environment. The project operated in co-operation with Watts from Waste Committee, Ministry of the Environment. (Specific Budgetary Program - Ministry of the Environment; S.W.E.E.P.)

Budget           \$8,000 (1973/74)

Report           To be prepared September 1973

Supervision     No direct supervisor from branch

DERELICT MOTOR VEHICLE PROGRAM

Objective        To develop costing and techniques for the removal, transportation and recycling of Derelict Motor Vehicles.

Description     Three pilot studies to compare efficiencies of different management structures for DMV removal and reclamation:

I Ministry supervised operation, private contract to move hulks.

II Ministry engages municipality to undertake full management of disposal, municipality assumes ownership of DMVs.

III Ministry engages counties to manage transactions, but maintains legal ownership of DMVs itself.

Sites             I - Sault Ste. Marie; II - Thunder Bay; III - Renfrew County

Duration        Commenced with a survey, 1972/73; pilot study to be completed  
1973/74

Commentary     Three separate contracts with Private Enterprise, Municipal Governments of Thunder Bay, and Renfrew County respectively, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Abandoned Automobiles).

Budget           \$100,000 (1973/74)

Report           None as yet

Supervision     G.M. Wood, Planning Supervisor

ENERGY RECOVERY FROM REFUSE: A FEASIBILITY STUDY

Objective To explore the use of beneficiated refuse as a fuel for utility boilers, cement kilns, etc. One component of "experimental reclamation plant" study.

Description An analysis of the potential, technical and economic, for utilizing waste as a fuel at the Lakeview Generating Station.

Duration August to October 31, 1973 Site Lakeview Generating Plant,  
Metro Toronto

Co-operation "Watts from Waste" Committee; Task Force on Solid Waste

Commentary A contract to Horner and Shifrin, Inc. Consulting Engineers funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Solid Waste).

Budget \$24,500 contract value

Report To be completed by October 31, 1973

Supervision G.M. Wood, Planning Supervisor

EXPERIMENTAL RECLAMATION PLANT

Objective        To design and build a facility to accommodate pilot programs generating recycling techniques for all classes of waste: municipal, domestic, industrial, construction. To construct a recycling model, relating processes developed to cost and market factors.

Description     A consulting firm will be hired to evolve detailed design and specifications for the plant. The pilot programs are not as yet developed.

Duration        Commenced 1972/73;                      Site     Metropolitan Toronto  
projected completion of plant  
construction - 1976/77;  
process development open-ended.

Commentary     An in-house research project of the Resource Recovery Group. Possible federal cost sharing for related research; co-operation expected from Metropolitan Toronto. (Specific Budgetary Program - Air and Land Pollution Control; Pollution Control; Solid Waste: .

Budget            \$200,000 (1973/74) - design implementation of plant; capital  
cost projection \$3 to \$5 million.     \$1,200,000. (1974/75)

Report            None as yet

Supervision     W. Williamson, Executive Co-ordinator, Resources Recovery Group.

GAS MIGRATION FROM THE BIRRELL - TRUSTRUM SANITARY LANDFILL SITE

Objective To investigate the problem of sub-surface methane gas migration from the landfill site, occurring beneath frost level.

Description Remedial techniques investigated:  
(1) Installation of interceptor ducts to prevent migration  
(2) Addition of vacuum pumps to interceptor ducts

Duration Commenced 1971/72; completed 1973 Site Birrell - Trustrum Landfill,  
Toronto

Commentary A contract with the University of Toronto Environmental Institute, Dr. Jones, funded by the Pollution Control Branch. (Specific Budgetary Program-Air and Land Pollution Control; Pollution Control; Solid Waste).

Budget \$12,800 (full project value)

Report Interim report complete

Supervision G.M. Wood, Planning Supervisor

LAND DRAINAGE REFERENCE (IJC) - POLLUTION POINT SOURCE IDENTIFICATION

Objective To study the effects of various land use activities on the quality of Great Lakes Boundary Waters. Alternative Management techniques will be recommended.

Description The Branch will identify point sources of pollution within the range of its expertise, and contribute data to demonstrate the identifiable point source contribution to the total pollution load balance.

Co-operation Federal government, U.S. I.J.C. authorities, related Ministries and branches of the Ministry of the Environment.

Duration Indefinite

Commentary An in-house project of the Pollution Control Branch. The investigation represents input from this branch to a major co-operative research program by the Federal Government American I.J.C. authorities, related Ministries and branches of the Ministry of the Environment.

Budget \$5,000 committed to date

Report To be issued by I.J.C.

Supervision G.M. Wood, Planning Supervisor

LITTER ANALYSIS - ROADSIDES

Objective To analyze the litter found on Ontario roadsides during the summer months, especially with respect to the contribution of consumer packaging.

Description Research teams collect litter along township roads, rural roads, and highways in Southern Ontario. Material collected is categorized under nine headings, for its type. Other factors noted are road characteristics, and weather conditions.

Duration Commenced 1972/73; four-month data collection period.  
On-going.

Commentary A SWEEP program project funded by the Ministry of the Environment, (Specific Budgetary Program - Ministry of the Environment; SWEEP).

Budget \$75,000 (1973/74) \$76,000 (1974-75)

Report Master report programmed in E.D.P. system. 1972/73 report submitted to Solid Waste Task Force.

Supervision G.M. Wood, Planning Supervisor



LITTER ANALYSIS - WASTE DISPOSAL SITES

Objective        To analyse waste occurring at public waste disposal facilities, especially with respect to consumer packaging contribution.

Description     A five- man special projects team is analysing garbage at selected disposal sites (incinerators, landfills) and recreation areas in urban and rural Ontario.

Duration        1973/74 - summer only

Commentary     An in-house research project of Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control; Pollution Control, (litter)).

Budget         \$10,000 (1973/74)

Report         Published report to appear, at project completion

Supervision     G.M. Wood, Planning Supervisor

ON-SITE COMPOSTING, MUNICIPAL WASTE

Objective        To explore the feasibility of applying shredded municipal refuse and sewage sludge to agricultural lands, for the cultivation of limited-use crops (animal feed).

Description      Experimental compost applied to a silage corn crop on a two-acre test site, ground water tested for conduct of heavy metals, bacti, and nutrients. Crop yield will be monitored.

Duration        Commenced 1971/72; projected completion 1974/75

Commentary      A research grant to the University of Guelph, Prof. L. Webber, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control; Pollution Control; Solid Waste)

Budget        \$12,000 (1973/74); overall \$7,000 per annum

Report        Interim report completed

Supervision     G.M. Wood, Planning Supervisor

## RED WORM COMPOSTING

Objective To experiment with effectiveness of stabilizing organic material, utilizing red worms as mixing agents and "harvesting" worms as an income supplement.

<u>Duration</u>	1972/73
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Site Newmarket

Commentary A research grant to Mr. Klauch, Newmarket, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control; Pollution Control).

Budget                      \$1,000 full project value

Report No.

<u>Supervision</u>	No direct supervision
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SANITARY LANDFILL STUDY

Objective To study the environmental impacts of landfill sites, especially with respect to migration of leachates.

Description Monitoring by test holes, of ambient ground water. Analysis of content for heavy metals, bacti, nutrients. Four old sites used to establish background data; new site selected to determine improvements achieved.

Duration Commenced 1971/72; projected Site Elmira, Brantford, Guelph  
completion 1974/75 Old Waterloo site

Commentary A research grant to the University of Waterloo, Prof, G.A. Farquhar, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Solid Waste).

Budget \$4,800 (1973/74; full project value \$40,000 approximately

Report Interim reports completed

Supervision G.M. Wood, Planning Supervisor

WASTE DISPOSAL AREA PLANNING STUDIES

Objective To investigate the feasibility, on an area-by area basis, of substituting a region-centred waste disposal facility for conventional location of sites according to municipal political boundaries.

Description Although essentially an "operations" activity, the planning studies constitute valuable prototype - development for reorganizing services along regional lines. Focuses include collection, transportation and disposal of waste.

<u>Duration</u>	Commenced 1971/72; to continue to 1978 minimum	<u>Site</u>	Hamilton-Wentworth; Oxford County; Halton County; Prince Edward County; Hastings County; Ottawa-Carleton; Regional Municipality of Niagara; Regional Municipality of Sudbury; Regional Municipality of Waterloo.
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Commentary An in-house research project of Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Solid Waste).

Budget \$250,000 (non-loan expenditure to date)

Report Final report from Oxford County

Supervision G.M. Wood, Planning Supervisor





ALTERNATIVES TO CHEMICAL CONTROL IN THE HOME GARDEN

Objective To assess pest prevalence, and damage inflicted in relation to the following practices:

- (a) Chemical pest control
- (b) Non-chemical control,
- (c) No controls applied

To develop safe, more acceptable alternatives to current practices.

Description Selected small domestic garden sites in suburban Toronto and Southern Ontario to be divided into the three management categories for one growing season. Periodic monitoring for pest occurrence, crop yield etc. Non - chemical techniques include traps, botanical insecticides, anti-feeding compounds.

Duration Commenced 1973/74; projected to extend over 2-3 growing seasons.

Commentary A research grant to the University of Toronto, Dr. G.B. Orlob, funded by Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget \$6,000 (1973/74)

Report None as yet

Supervision Pesticides Advisory Committee



CONTROL OF THE ONION MAGGOT, *HYLEMYA ANTIQUA* (MEIGEN), BY USE OF THE STERILE  
MALE TECHNIQUE

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Objective To evaluate the biological and physical parameters that determine the successful use of the sterile male technique to control the onion maggot.

Description Both laboratory and field tests will be conducted, primarily to determine the optimal age and stage for cobalt 60 sterilization of flies, competitiveness of treated flies and procedure and time for release. A small scale release will be made in 1973.

Duration Open-ended                      Site Holland Marsh (Field Studies)

Commentary A research grant to the University of Guelph, Ontario Agricultural College, department of Environmental Biology, Dr. F. McEwen, funded by Pollution Control Branch. Cooperative research by Dr. C.R. Harris Agriculture Canada. London, Ontario. (Special Budgetary Program - Air and land Pollution Control: Pollution Control; Pesticides Control).

Budget \$18,000 (1973/74)

Report None as yet

Supervision Pesticides Advisory Committee

DERIVATION OF A CARROT BLIGHT SPRAYING SCHEDULE CORRELATED WITH WEATHER  
CONDITIONS WHICH FOSTER FUNGAL GROWTH

---

Objective To determine whether more efficient and environmentally safe scheduling practices can be attained for fungicide spraying, by substituting applications during peak disease development stages (indicated by pathology of the plant, and meteorological factors) for regular - interval applications.

Description Study of reactions of fungi causing carrot blight, to temperature, humidity, light, and leaf wetness duration, in an incubation chamber. Refinement of resulting model by field testing.

Duration Not specified                      Site Bradford Marsh

Commentary A research grant to the University of Guelph, Land Resource Science, Dr. T.J. Gillespie, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control)

Budget \$7,175 (1973/74)

Report None as yet

Supervision Pesticides Advisory Committee

THE EFFECT OF CARBOFURAN ON THE PHYSIOLOGY OF PLANTS

Objective        To explore the possibility that application of carbofuran produces physiological changes in corn plants, hence increasing yield quite apart from its insect control function. Tests will also ascertain the environmental conditions under which carbofuran does increase crop yield.

Description    In an insect-free environment, the effect of carbofuran will be determined on various plant and soil types, in sterilized and non-sterilized soil and possibly in hydroponic growth tanks.

Duration :        One year. (1973/74)

Commentary      A research grant to the University of Guelph, Dept. of Environmental Biology, Dr. R.A. Fletcher, funded by the Pollution Control Branch. (Specific Budgetary Program- Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget            \$5,000

Report            None as yet

Supervision      Pesticides Advisory Committee

EFFECT OF DURSBAN APPLIED IN THE FORM OF A LARVICIDE PREPARATION UPON THE  
MICROFLORA UPTAKE IN BOTTOM SEDIMENTS

---

Objective            To determine the seasonal persistence of Dursban, its incorporation into, and its excretion from, sedimentary micro- flora.

Description        Pilot studies in a water body contiguous to the site will provide indicators and parameters for applications to small, self-contained areas of the test site. A plan will be formulated for major studies involving the whole test site.

Duration            Open - ended            Site    Great Lakes Research Station,  
Baie du Dore, Lake Huron.

Commentary        A research grant to the University of Toronto, Institute of Environmental Sciences and Engineering, Dr. J.R. Brown, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control)

Budget                \$5,000 (1973/74)

Report                None as yet

Supervision        Pesticides Advisory Committee

EFFECT OF DURSBAN (USED AS A MOSQUITO LARVICIDE) ON MICROSCOPIC  
PLANKTONIC AND MICROBIAL FORMS OF LIFE

---

Objective To explore the effects of application of Dursban on the fundamental, processes of zooplankton and phytoplankton, and assess the ramifications with respect to their roles in the food chain, and as agents of decomposition and nutrification. To attempt to set up an appropriate pesticide model for microscopic aquatic forms.

Description Short-term and long-term (one year) assessment of effects of the three applications of Dursban on organic decomposition in artificially constructed ponds. Evaluation of changes in diversity indices on organisms grouped according to ecological activity.

Duration One year (1973/74)

Commentary A research grant to York University, Dept. of Biology, Dr. M. Boyer, Dr. C.D. Fowle, funded by Pollution Control Branch. (Specific Budgetary Program-Air and Land pollution Control: Pollution Control; Pesticides Control).

Budget \$6,000

Report None as yet

Supervision Pesticides Advisory Committee

EFFECTS OF APPLICATIONS OF DIPYRIDYL HERBICIDES TO SOIL AND WATER ON MICROBIAL  
NON-TARGET ORGANISMS

---

Objective        To determine what possible effects dipyridyl herbicides may have on fundamental activities of microbiological life forms in soil and water.

Description     Monitoring migration of applied herbicides in soil and water (field and laboratory trial applications). Assessment of effects of applications on numbers, and biochemical activities, of representative samples of the microbial population in soils and sediments.

Duration        One year (1973/74)

Commentary     A research grant to the University of Waterloo, Department of Biology, Dr. C.I. Mayfield. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget         \$5,000

Report         None as yet

Supervision     Pesticides Advisory Committee

ELECTROSTATIC APPLICATION OF PESTICIDES IN ORCHARDS AND FIELD CROPS

Objective To explore the feasibility of using minimum-waste electrostatic pesticide application techniques for orchard and field crop foliage, and to develop a working applicator model, suitable for mounting on a tractor.

Description The thesis will be explored, that the properties of a tree as a Faraday Cage facilitate electrostatic application of pesticides by aerosol injection of spray into the field-free region. Testing will be under field conditions.

Duration One year (1973/74)      Site Test orchard, University of Guelph

Commentary A research grant to the University of Western Ontario. Faculty of Engineering Science, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget \$5,000

Report None as yet

Supervision Pesticides Advisory Committee

INTERACTIONS OF TRIAZINE HERBICIDES WITH SOIL AND FRESH WATER ENVIRONMENTS  
(BLADEx & SENCOR)

---

Objective        To eliminate some of the inadequacies in documentation of mechanisms of transport from soils to aquatic systems, and of the physical, chemical and biological properties of these substances in the latter system.

Description     Examination of the microbial and chemical transformations of triazine herbicides in selected Ontario soils: study of leaching and surface displacement of parent chemicals and major degradation intermediates. Study of mechanisms and rates of decomposition in aqueous and sedimentary phases, effects of interaction with urban and industrial effluents. Study of effects of chemicals on aquatic biological activities.

Duration        One year. (1973/74)

Commentary     A research grant to the University of Guelph, Department of Microbiology, Dr. C.T. Corke, funded by the Pollution Control Branch. (Specific Budgetary Program - Air And Land Pollution Control: Pollution Control; Pesticides Control).

Budget           \$7,500

Report           None as yet

Supervision     Pesticides Advisory Committee



POTENTIAL HAZARD TO BIRDS FROM GRANULAR FORMULATIONS OF PESTICIDES

Objective        To expand information on the behaviour of various species of wild birds with respect to ingestion of granular pesticides as food, and to produce statistics contrasting the relative response of small passerine species to dosages of various granular pesticides.

Description    Laboratory tests will demonstrate wild bird response to granular pesticides; field tests will be conducted with granular pesticides and an aluminum powder tracer to determine ingestion behaviour in natural habitat. Possible further tests to explore harmfulness of pesticides, if ingestion is observed to occur widely.

Duration        Not specified

Commentary     A research grant to York University, Department of Biology, Dr. C.D. Fowle, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticide Control).

Budget           \$3,000 (1973/74)

Report           None as yet

Supervision     Pesticide Advisory Committee

REDUCTION OF HERBICIDAL DRIFT IN ROADSIDE SPRAYING

Objective        To generate comparative data on the effectiveness of herbicide sprays whose physical properties have been altered (particulation, emulsification, etc.) for the purpose of reducing spray drift.

Description     A minimum of ten drift control materials will be used in combination with standard 2, 4-D herbicide, and applied in the field by a roadside spraying vehicle. Drift will be measured fluorimetrically, by bioassay of growth inhibition and by gas liquid chromatography. Meteorological and droplet size factors will be correlated with the drift results.

Duration        One year    (1973/74)

Commentary     A research grant to the University of Guelph, OAC Department on Environmental biology, Dr. G.R. Stephenson, funded by Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget         \*        \$8,000 (1973/74)

Report         None as yet

Supervision     Pesticides Advisory Committee

REGISTRATION OF COMPOUNDS FOR THE CONTROL OF CUTWORMS ON  
HORTICULTURAL CROPS GROWN ON MINERAL SOILS

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Objective        To test cutworm control pesticides (alternatives to DDT) which prove effective on subterranean feeding species, so as to prove them registrable for general use on horticultural crops grown on mineral soils.

Description    Maintenance of field plots, May to September, 1973. Collection of efficacy, spray residue and phytotoxicology data of Phosvel and Dursban on dark-sided cutworms (most common problem) with pre-and post-planting field treatments of cucumber, potato, tomato and pepper crops.

Duration        Commenced October 1973; indefinite length.

Commentary     A research grant to The Ontario Fruit and Vegetable Growers Association, funded by the Pollution Control Branch. The Association's program is also supported by the Federal Department of Agriculture and the Ontario Ministry of Agriculture and Food. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control)

Budget           \$2,5000 (1973/74)

Report           None as yet

Supervision     Pesticides Advisory Committee



STUDIES OF THE RATE OF EVAPORATION OF PESTICIDES, PARTICULARLY DIAZINON  
AND PARATHION UNDER ONTARIO CLIMATIC CONDITIONS

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Objective        To improve assessment of transport rates and mechanisms of pesticides in the environment with attention to meteorological variables, leading to suggestion of improved methods of application. To provide a rating of pesticides by tendency to evaporate.

Description     Current literature search. Laboratory studies of evaporation rates under mass transfer geometries, including wind tunnel and bubble evaporation systems.

Duration        Commenced 1973/74

Commentary     A research grant to the University of Toronto, Department of Chemistry and Applied Engineering, Dr. P. McKay, funded by the Pollution Control Branch. (Specific Budgetary Program - Air and Land Pollution Control: Pollution Control; Pesticides Control).

Budget           \$4,420 (1973/74)

Report           None as yet

Supervision     Pesticides Advisory Committee

BIOLOGICAL DE-NITRIFICATION PROCESS

Objective      Anticipating imposition of requirements for nitrate removal in sewage treatment plants, this is the first stage in a full-fledged study of nitrate removal processes.

Description      Experimental conversion of old plants to facilitate nitrogen removal.

<u>Duration</u>	Formally, 1972	<u>Site</u>	New market - pilot scale
	to 1976; open-ended as a practical prediction		Brampton - experimental facility

Commentary      An in-house research project of the Pollution Control Branch, funded through the Canada - Ontario Agreement on the Lower Lakes.

<u>Budget</u>	\$33,500 (1972/73);	\$24,000 (1973/74)	continuing	\$27,000	74-75
				\$36,000	75-76

Report      Available October, 1973

Supervision      S.A. Black, Supervisor, Wastewater Treatment.  
A. Smith

CARBON ADSORPTION WASTE TREATMENT

Objective        To distinguish between three possible methods of employing activated carbon in waste treatment, with a view to removing dissolved substances.

Description     The three methods are:  
(1) powdered carbon to primary clarifier;  
(2) powdered carbon to aeration section;  
(3) granular carbon beds following secondary treatment.

Duration        April, 1972 to 1976

Commentary     An in-house research project of the Pollution Control Branch, funded through the Canada - Ontario Agreement on the Lower Lakes.

Budget         \$77,000 (1972/73);    \$32,000 (1973/74)

Report         March 1976

Supervision     G. Rupke, Head, Wastewater Treatment Section.  
N. Ahlberg.

CENTRIFUGATION OF SEWAGE

Objective        To evaluate centrifugation as an alternative to settling basins for primary sewage treatment.

Description     A comparison of effluent from a centrifuge, fed raw sewage, with conventional process sedimentational effluent.

Duration        April, 1972 to April, 1974

Commentary     An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Applied Sciences)

Budget         22 man-hours, \$5,000 capital

Report         To be prepared upon completion

Supervision    M. B. Fielding, Supervisor, Applied Sciences



CHARACTERIZATION OF FILAMENTOUS BACTERIA

Objective        To determine the nature of bacteria which resist settling in treatment process.

Description     Studies are being carried out using model activated sludge plants to determine the growth characteristics of nuisance filamentous bacteria.

Duration        1973 - 1975

Commentary     An in-house research project of the Pollution Control Branch, with informal cooperation from the Canada Center for Inland Waters. (Specific Budgetary Program - Pollution Control; Wastewater Treatment, Nutrient Removal).

Budget           Continuing - 1,500 man-hours

Report           To be prepared upon completion

Supervision     S.A. Black, Supervisor, Nutrient Removal and Special Studies;  
A. Smith

CHEMICAL PROCESS CRITERIA FOR PHOSPHORUS REMOVAL

Objective        To develop phosphorus removal techniques suitable for consolidation with each sewage treatment process currently used in Ontario, with a view to meeting the government directive that all plants discharging into Lake Erie, and into most of the inland recreational lakes, incorporate phosphorus treatment processes by the end of 1973.

- Description        (1) Effect of Fe Cl on anaerobic digestion - Sarnia  
                              (2) Effect of aluminum on an area lagoon - Grimsby
- (3) Fe Cl to primary raw sewage - Barrie
  - (4) Fe Cl to an aerobic digester
  - (5) Fe Cl to raw activated sludge - Chatham
  - (6) Fe Cl to aeration of activated sludge - Chatham
  - (7) Aluminum to an oxidation ditch - Port Elgin
  - (8) Fe Cl to an oxidation ditch - Port Elgin
  - (9) Aluminum to a contact stabilization plant - Picton
  - (10) Fe Cl to a contact stabilization plant - Picton
  - (11) Dry lime to raw activated sludge - Ingersoll
  - (12) Nutrient removal alum to an activated sludge plant - Barrie
  - (13) Alum to a seasonal retention waste stabilization pond - Port Arthur
  - (14) Alum to a soft water area activated sludge plant - North Bay
  - (15) Lime to a seasonal retention waste stabilization pond - Tottenham
  - (16) Fe Cl to a seasonal retention waste stabilization pond - Sutton
  - (17) Aluminum to a seasonal retention waste stabilization pond - Shelburne

Duration            Completed

Commentary      An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Development and Research).

Budget            \$90,000 total to date; \$60,000 (1973/74)

Report.            To be published during 1973; report on sewage lagoon batch  
treatment process will appear separately.

Supervision      P.D. Foley, Development & Research

CHEMICAL TREATMENT OF SEWAGE LAGOONS

Objective      To explore chemical treatment of sewage lagoons for removal of nutrients and destruction of bacteria.

Description      Batch treatments done with approximately 15 different chemical combinations, in the field.

Duration      1971 to 1974  
Completed

Sites      Arthur, Tavistock, Aylmer  
Listowel, Sutton, Toddenham,  
Beaverton, Chelmsford, Bala Bay

Commentary      An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes (Specific Budgetary Program - Pollution Control; Wastewater Treatment, Nutrient Removal).

Budget      \$5,000 (1972/73); \$20,000 (1973/74).

Report      Anticipated in Autumn, 1973

Contact      S.A. Black, Supervisor, Wastewater Treatment  
R. Hunsinger.

COLOUR REMOVAL FROM POTABLE WATER

Objective            To reduce solids generated in producing potable water supply. To develop a treatment process which will remove colour satisfactorily, will require minimum supervision, and will lend itself to application in small water treatment plants.

Description        Evaluation in the field of processes developed in laboratory, including oxidation reactions, adsorption onto carbon, and enhanced bacteriological consumption of colour-producing substances.

Duration            1973 - June/75 Site Smiths Falls - specific application to  
brackish waters in Northern Ontario

Commentary        An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Water Technology Section).

Budget              \$6,000 salary, \$3,000 capital

Report              To be produced when project completed.

Supervision        K. Roberts, Water Technology Section.

# COMPARISON OF SUITABILITY OF VARIOUS VEHICLE TYPES FOR APPLYING SEWAGE SLUDGE TO LAND

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<u>Objective</u>	To find the best type of vehicle for this purpose.
<u>Description</u>	Research acts as a co-ordinating supervisor of the project.
<u>Duration</u>	1973 to March 1975      Completed
<u>Commentary</u>	A contract to the regional municipality of Niagara, funded through the Canada-Ontario Agreement on the Lower Lakes. The Special Studies Section is charged with supervising this project. (Specific Budgetary Program - Pollution Control; Wastewater Treatment).
<u>Budget</u>	\$15,000 - \$20,000 (1973/74)      \$1,500      = 74-75
<u>Report</u>	In preparation
<u>Supervision</u>	S.A. Black, Wastewater Treatment Section, Supervisor.

EFFICIENCY OF CHLORINE DISINFECTION IN SEWAGE TREATMENT PLANTS

Objective            To determine causes of intermittent failure of the chlorination process in the destruction of bacteria in sewage plant effluents.  
                         To examine post-chlorination revival of bacteria.

Description        (1) On-site chlorine residual tests  
                         (2) Collection of selective samples for bacterial analyses  
                         (3) Tracer test to determine mixing patterns in chlorine contact basins.

Duration            Open-ended

Commentary        An in-house research project of the Pollution Control Branch. The problem was originally discovered by the Technical Advisory Services Section of the former Research Branch; all routine analyses (bacterial, chemical) are done by Laboratory Services Branch. Project is being carried out at plants operated by Projects Operations Branch. (Specific Budgetary Program - Pollution Control; Water Technology).

Budget                One research scientist plus technician, 25% of time.

Supervision        A. Oda, Senior Engineer, Water Technology

EFFLUENT POLISHING

Objective To make improvements in sewage effluent quality, on all parameters, by adding processes removing solids as well as phosphorus compounds.

Description Experimentation with addition of primary coagulants, coagulant aids and filter aids prior to filtration.

Duration April, 1972 to March 1975. Completed

Commentary An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control; Development and Research).

Budget \$42,100 (1972/73); \$32,800 (1973/74) ; \$6,000. (1974-75)

Report March, 1975

Supervision G. Rupke, Head, Wastewater Treatment.  
R. Hunsinger.



EUTROPHICATION REVERSAL PROCESS

Objective        To discover methods of removal of algae and nutrients from eutrophied water bodies.

Description      Study in early stages; no final enumeration of treatments to be applied.

Duration        Commenced 1970, continuing study

Commentary      An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Wastewater Treatment)

Budget         \$3,000 - \$4,000 to date; total commitment uncertain

Report         No formal report

Supervision     S.A. Black, Supervisor, Wastewater Treatment

EVALUATION OF EFFECT OF NUTRIENT REMOVAL ON STREAM - POND SYSTEM

Objective        To monitor the impact of a phosphorus - removal plant on water quality in an entire stream - pond system. To test a new style of phosphorus removal "package plant".

Duration        Commenced 1970/71;        Site Maple  
Completed July, 1973

Commentary      An in-house research project by the Pollution Control Branch in co-operation with the Ministry of Natural Resources (Specific Budgetary Program - Pollution Control: Wastewater Treatment)

Budget            600 man-hours; \$10,000 capital

Report            To be written

Supervision      S.A. Black, Supervisor, Wastewater Treatment

EVALUATION OF A SMALL CHLORINATOR FOR LOW-VOLUME ISOLATED OPERATIONS

Objective            To evaluate performance and disinfecting efficiency of a proprietary device developed for chlorinating small volumes of sewage effluents from package type of sewage treatment plants.

Description        The chlorinator was installed as a pilot plant at three different sewage plants to treat small volumes of sewage effluents. Some on-the-site tests were conducted as well as routine sampling of bacterial and chemical analysis. Some work was also performed in the laboratory to check and test the quality of chemicals used in conjunction with the above device.

Duration            Commenced September, 1971. Field and Lab. testing completed by June, 1972, report by September, 1972. No further study contemplated unless by request from another Branch of the Ministry.

Commentary        An in-house research project of the Pollution Branch by request of the Sanitary Engineering Branch. (Specific Budgetary Program - Pollution Control; Water Technology)

Budget              650 man-hours

Report              Evaluation of Sanuril Wastewater Chlorinator, R.P. 2038

Supervision        A. Oda, Senior Engineer, Water Technology

EVALUATION OF TURBIDIMETRY AS A TECHNIQUE FOR MEASURING SUSPENDED SOLIDS IN  
SEWAGE EFFLUENTS

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Objective To evaluate the adaptability of turbidity measurements based on light reflection to the monitoring of suspended solid content in sewage effluent.

Description A comparison of turbidity readings, to suspended solid weight in individual effluent samples.

Duration Commenced, June 1972; projected completion, March, 1974.

Commentary An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Development & Research.)

Budget \$5,000 (salary)

Report Being prepared for publication

Supervision P.D. Foley, Development & Research

AN EXAMINATION OF SEWAGE AND SEWAGE SLUDGE FOR ENTEROVIRUSES

Objective        To ascertain the health hazard with respect to viruses which may be associated with sewage and sewage sludge disposal.

Description     A program of testing raw sewage, sewage effluent, and water, draining from land on which sewage sludges are spread, for presence of enteroviruses.

Duration        Commenced September, 1972; to be completed April 1976

Commentary     An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes. The Ministry of Health is co-operating in this project. (Specific Budgetary Program - Pollution Control; Development & Research)

Budget           \$13,000 (1972/73);    \$11,000 (1973/74)  
                     continuing -\$15,000 - 74-75  
                                     \$10,000 - 75-76

Report           Final Report April 1976

Supervision     K. Roberts, Supervisor Water Technology.  
                     Mrs. A. Vajdic, Microbiologist.

EXPERIMENTAL SHALLOW- PIPELINE WATER TEMPERATURE MONITORING

Objective To determine whether a styrofoam barrier between pipe and soil surface will prevent freezing when pipeline is not laid below frost line.

Description Temperature inside an experimental section of watermain and surrounding soils is monitored automatically. Charts analyzed by Research Branch staff.

Duration January 1973 to August 1975      Site Blizzard Valley

Commentary An in-house research project of the Pollution Control Branch by referral from the Project Construction Branch. (Specific Budgetary Program - Pollution Control: Applied Sciences).

Budget \$10,000 (monitoring equipment)

Report To be prepared upon completion of project.

Supervision M.B. Fielding, Supervisor, Applied Sciences

FRAZIL ICE STUDY

Objective        To predict the likelihood of occurrence of frazil ice in water treatment plant intakes.

Description     A statistical review of historical data on occurrence of the ice formations, with special attention to isolation of high risk design characteristics.

Duration        Open-ended, consultative program.

Commentary     An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Applied Sciences)

Budget         1000 man hours so far.

Report         Available - No. W43

Supervision    M.B. Fielding, Supervisor, Applied Sciences

HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES

Objective        Anticipates disposal demands for chemical sludges when chemical treatment processes proliferate.

Description     Investigation of transport of heavy metals from sludge disposal sites, through ground water percolation, surface water runoff, and vegetation. Provision of samples from various phosphorus removal facilities, as well as conventional plants.

Duration        1972 to March, 1976

Commentary     A contract to the University of Toronto, Dr. Van Loon, funded through the Canada-Ontario Agreement on the Lower Lakes. The Special Studies Section provides samples for the study and serves the liaison function. (Specific Budgetary Program - Pollution Control; Wastewater Treatment)

Budget            \$15,000 (1972/73); \$10,000 (1973/74)  
                     continuing - \$10,000 74-75  
                                 \$ 7,500 75-76

Report            1972/73 year end report

Supervision      S.A. Black, Supervisor, Wastewater Treatment.



INVESTIGATION OF BACTERIOLOGICAL POPULATION OF WATER DISTRIBUTION SYSTEMS

Objective            To ensure acceptable standards of algae control and disinfection inside potable water conduits.

Description        Identification of organisms removed from water pipes by foam swabbing; analysis of response to current disinfection techniques.

Duration            Commenced 1973; open - ended

Commentary        An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Development & Research.

Budget              Indefinite

Report              None as yet

Supervision        P.D. Foley, Development & Research

INVESTIGATION OF THE PHYSICAL - CHEMICAL SEWAGE TREATMENT PROCESS

Objective To investigate the partial to complete treatment of sewage by physical/chemical processes, as an alternative to biological treatment.

Description After primary treatment, chemicals are added to the water for phosphorus removal; sand filtration follows (for solids removal), and then a carbon adsorption process (organics removal).

<u>Duration</u>	Commenced April 1972	<u>Site</u>	The Point Edward plant
	to continue until at		(Sarnia)
	least 1976		

Commentary An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement of the Lower Lakes. (Specific Budgetary Program - Pollution Control; Wastewater Treatment)

<u>Budget</u>	\$52,000 (1972/73); \$41,000 (1973/74), (salaries included)
	continuing - \$102,000 74-75
	\$ 65,000 75-76

<u>Report</u>	Forthcoming October, 1973
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<u>Supervision</u>	G. Ruphe, Head, Wastewater Treatment.
	N. Ahlberg.

INVESTIGATION OF RAINFALL-TILE FLOW CORRELATION

Objective        To provide data for municipal decisions on advisability of conducting rainfall run-off through storm sewers.

Description    First phase (complete) - investigate opportunity sites. Second phase - explore and implement design housing.

Duration        April 1970 to March 1975

Commentary     An in-house research project of the Pollution Control Branch originally requested by the Municipal Engineers Association through the Ministry of the Environment, Municipal Engineers Committee. Ontario Housing Commission will provide experimental units for the second phase. (Specific Budgetary Program Pollution Control; Applied Sciences)

Budget          200 man-hours/year; \$3,000 capital

Report          Available - No. 2033 (Phase I)

Supervision    M.B. Fielding, Supervisor, Applied Sciences

LAND DISPOSAL OF SEWAGE AND SEWAGE EFFLUENT

Objective To explore the feasibility of irrigating agricultural lands by applying sewage effluent, in a temperate but seasonal climate with moderate rainfall. Secondary application to seepage from sewage lagoons.

Description (1) Effluent is applied by surface spraying, and by sub-surface injection; ground water monitored for bacterial and viral survival and transport. Airborne transmission of pathogenic elements examined.

(2) Determination of maximum rates of application for given soil types.

(3) Determination of quality of effluent which will prevent infiltration when sprayed on various soil types.

(4) Development of model (pilot plant - physical) to be used by consultants for pre-design studies.

Duration 1971 to 1975 (3 year per site) Sites Smithville (surface run-off  
Unionville (injection)  
Port Rowan (pilot model)

Commentary An in-house research project of the Pollution Control Branch funded partially through the Canada-Ontario Agreement of the Lower Lakes and partially by the Pollution Control Branch. (Specific Budgetary Program - Pollution Control; Applied Sciences).

Budget Total - 8,000 man-hours; \$25,000 total cost of in-house activities by Research Branch.

Supervision M.B. Fielding, Supervisor, Applied Sciences

LAND DISPOSAL OF SEWAGE SLUDGE

Objective To determine the possible adverse effects on soil and crops, of sewage sludge applied to agricultural land.

Description Research Branch in a liaison role, provides samples, materials and technical advice. The investigation itself is conducted at Guelph University. Variables measured include heavy metals, nutrients and microbiological forms.

Duration Commenced 1971; projected completion, March 1978

Commentary A contract to the University of Guelph, Professor Bates, funded through the Canada-Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control; Wastewater Treatment).

Budget \$50,000 (1972/73); \$125,000 + \$30,000 (1973/74)  
(final figure of \$30,000 not yet approved)  
Continuing - \$145,000 74 - 75  
180,000 75 - 76

Report (1) Literature survey (2) 1972/73 year end report.

Supervision S.A. Black, Wastewater Treatment

MUNICIPAL SEWAGE BY-PASS FLOWS

Objective        To generate sewage treatment plant designs which will provide adequately for "peak flows".

Description     Present practice is to by-pass the sewage treatment plant during periods of excess flow. The by-passed flow is not metered. This program is designed to meter by-passed flows, and thereby to establish true current peak design plant flow rates.

Duration        1973 to 1976

Commentary     An in-house research project of the Pollution Control Branch, funded through the Canada - Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control; Wastewater Treatment).

Budget           \$43,000 (1973/74) continuing \$29,000 (74-75) \$17,000 (75-76)

Report           None as yet

Supervision     F. Tonelli, Head, Wastewater Treatment Section.

OIL SPILL CONTROLS AND CLEAN-UP

Objective        To test various chemical agents for oil spill removal. To perfect standardized test procedures so that all oil treating agents can be uniformly evaluated without elaborate procedures.

Description     Factors studies include relative effectiveness of each oil treating agent on various types of oil, effects of agents on water quality, toxicity of the agents to fish and aquatic life.

Duration        Open-ended. The development of testing procedures is completed, continuing activity involves applying tests to new products introduced to the market.

Commentary     An in-house research project of the Pollution Control Branch. The Canadian Center for Inland Waters, Emergency Services Branch, conducts a co-operative testing program for sorbent materials under simulated field conditions. (Specific Budgetary Program - Pollution Control; Water Technology).

Budget           3,000 man-hours, \$5,000 capital (total project value)

Supervision     A. Oda, Senior Engineer, Water Technology

PHYSICAL - CHEMICAL WATER TREATMENT PLANT

Objective            To improve water supply treatment procedures.

Description        (1) To determine optimum juncture for addition of ferrous sulphate in the activated sludge process.

                          (2) To investigate the applicability of an activated carbon (fly ash) treatment to effect carbon removal from waste treatment plant effluent, as compared to the use of activated carbon.

Duration            (1) Commenced 1972; to be completed end of 1973  
                          (2) Commenced 1973; open-ended

Commentary        An in-house research project of the Pollution Control Branch.  
(Specific Budgetary Program - Pollution Control; Wastewater Treatment Removal)

Budget              (1) 400 man-hours  
                          (2) 600 man-hours per annum.

Report              No formal report yet.

Supervision        S.A. Black, Supervisor, Wastewater Treatment, W. Lewandowski



PLASTIC SEWER PIPE ASSESSMENT

Objective        To provide data for Ministerial regulations on design criteria for buried plastic sewer pipes.

Description    Theoretical evaluation of pipe-soil interaction supported by laboratory pipe testing.

Duration        Open-ended function

Commentary    An in-house research project of the Pollution Control Branch. (Specific Budgetary Program - Pollution Control Applied Sciences).

Budget         1,000 man-hours; no capital outlay

Report         Available - No. 2036

Supervision    M.B. Fielding, Supervisor, Applied Sciences

PROBLEM IDENTIFICATION AT SEWAGE TREATMENT PLANTS

Objective        To determine design modifications advisable in future plant engineering.

Description      Exploration of problems as they arise; characterization of design defects related to specific recurrent problems.

Duration         March 1973 to March 1976

Commentary        An in-house research project of the Pollution Control Branch, funded through the Canada - Ontario Agreement on the Lower Lakes.

Budget            \$15,000 (1973/74)   continuing   \$15,000 (74-75)   \$20,000 (75-76)

Report            None as yet

Supervision       G. Rupke, Head, Wastewater Treatment Section.  
C. Howes.

REVERSE OSMOSIS WASTEWATER TREATMENT PROCESS

Objective            To determine advantages and disadvantages of purifying waste water beyond current Ministerial standards of acceptability.

Description        Compare costs of further purifying wastes by processes producing a saleable by-product, to those of accelerating anaerobic bacterial digestion by heating (no by-product produced). Cheese whey is current experimental waste medium. Additional potential applications - water softening for gypsum rock wells; producing sodium - free potable water for specialized medical problems.

Duration            3 years (April 1972 to April 1975)

Commentary        An in-house research project of the Pollution Control Branch, by reference from the Industrial Wastes Branch. Additional applications will also relate to responsibilities of the Sanitary Engineering Branch. (Specific Budgetary Program - Pollution Control; Applied Sciences)

Budget              \$20,000 per annum (3,000 man-hours, \$2,000 capital).

Report              To be prepared upon completion of project.

Supervision        M. B. Fielding, Supervisor, Applied Sciences.

SEQUESTERING OF IRON AND MANGANESE FROM WATER SUPPLY

Objective            To standardize a process which will satisfy Ministry objectives for colour in water supplies (0.3 parts per million - iron; .05 parts per million - manganese).

Description        Application of a silicate in treatment process.

Duration            Developmental task completed 1970; consultative role on applications anticipated to continue to 1975.

Commentary        An in-house research project of the Pollution Control Branch (Specific Budgetary Program - Pollution Control; Development & Research)

Budget              \$6,000 per annum (approximately).

Report              Published Journal of American Waterworks Association

Supervision        P. D. Foley, Development & Research

Supervision S. A. Black, Supervisor, Wastewater Treatment

SEWAGE TREATMENT BY GAMMA IRRADIATION

Objective To investigate the application of gamma irradiation on a pilot scale to conventional secondary sewage effluent.

Description Monitoring of secondary sewage effluent at a conventional plant, both before and after exposure to gamma irradiation in a pilot irradiator. Parameters monitored in the effluents included indicator and pathogenic bacteria, viruses, COD, BOD, phosphates, solids, nitrogen.

Duration Commenced August, 1972; to be completed by the end of 1973

Commentary An in-house research project of the Pollution Control Branch, with the co-operation of Atomic Energy of Canada Limited, Geodol Incorporated, and McMaster University. (Specific Budgetary Program - Pollution Control; Development & Research)

Budget Salaries for one microbiologist, 6% of the time, and one technician, 6% of the time.

Report Final report, end of 1973

Supervision P. D. Foley, Development & Research, Mrs. A. Vajdic, Microbiologist.

SEWAGE TREATMENT PLANT ODOUR CONTROL

Objective            To apply engineering technology for odour control in sewage plant operations.

Description        Investigations relate to individual plants as problems arise.

Duration            Open-ended

Commentary        An in-house research project of the Pollution Control Branch with the co-operation of the Air Resources Branch. (Specific Budgetary Program - Pollution Control; Applied Sciences)

Budget              500 man-hours to date

Report              Internal progress report

Supervision        M. B. Fielding, Supervisor, Applied Science

SMALL-SCALE CARBON REGENERATION STUDIES

Objective            To determine the feasibility of recovering carbon used in the waste treatment process, on a small scale, exploring the variety of methods of regeneration.

Description        Evaluation has indicated that only one regeneration process is economical at a small scale. The smallest full size furnace will be operated.

Duration            Commenced April, 1973; to 1976.

Commentary        An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control; Development & Research)

Budget              \$85,000 (1973/74)    \$45,000. (1974-75)    \$15,000. (1975-76)

Report              None as yet

Supervision        S.A. Black, Supervisor, Wastewater Treatment  
N. Ahlberg



STORM WATER TREATMENT

Objective            To discover methods of treating storm water adequately without applying full sewage disinfection process.

Description        Self-cleaning rotating screens, tested on site. Site Belleville

Duration            Continuing

Commentary        An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control; Development & Research)

Budget              \$13,400 (1972/73); \$63,000 (1973/74)

Report              August 1975

Supervision        F. Tonelli, Head, Wastewater Treatment  
H. Kronis

A STUDY OF HEPATITIS OCCURRENCE RATE IN A WATER TREATMENT PLANT

Objective            Exploration of possible reasons for the occurrence of hepatitis in a particular Ottawa water treatment plant.

Description        Concentration of samples of raw water (before treatment), water plant sludge, and final treated water, preparatory to isolation of the hepatitis virus by the Ministry of Health. Control samples are being collected from a Brantford plant.

Duration            Commenced May, 1973; open-ended

Commentary        An in-house research project of the Pollution Control Branch, funded through the Canada-Ontario Agreement on the Lower Lakes. The program was initiated through Sanitary Engineering Branch on the request of the Ottawa Medical Officer of Health. (Specific Budgetary Program - Pollution Control; Development & Research)

Budget              One microbiologist, 40% of time.

Report              Interim report, August, 1973.

Supervision        P. D. Foley, Development & Research, Mrs. A. Vajdic, Microbiologist.

TASTE AND ODOUR REMOVAL - POTABLE WATER SUPPLY

Objective            Immediate - to identify the nature of problem-generating substance (primarily algal, sometimes heavy metals). Long-term - to evaluate specific species of algae in exposure to all the known forms of water treatment, and to anticipate peaking periods of algal bloom.

Description        Test effects of sediment action and filtration on removal of algae and their taste/odours.

Duration            Commenced 1968, open-ended.

Commentary        An in-house research project of the Pollution Control Branch by referral from individual municipalities as problems arise. (Specific Budgetary Program - Pollution Control; Development & Research).

Budget              Average \$6,000 per annum (salaries), depending on rate of problem occurrence.

Report              No

Supervision        P. D. Foley, Development & Research

THERMOPHILIC ANAEROBIC DIGESTION

Objective To enhance the effects of a digester by maintaining a higher operating temperature; and to determine the effects of the new chemical sludges on the digestion process.

Description Operation of a conventional digester at an elevated operating temperature of 120° to 130°F.

Duration April, 1973 to September 1976

Commentary An in-house research project of the Pollution Control Branch, funded through the Canada - Ontario Agreement on the Lower Lakes. (Specific Budgetary Program - Pollution Control: Wastewater Treatment Section).

Budget \$36,000 (1973/74), mainly representing initial capital expenditure continuing \$35,000 (74 - 75) \$50,000 (75-76)

Report January, 1976

Supervision S.A. Black Supervisor, Wastewater Treatment Section.  
J. Smart

WATER TREATMENT BY DIRECT FILTRATION

Objective To provide alternative water treatment process which will lower plant construction costs and reduce the amount of sludge produced.

Description Experimentation with a direct filtration process which would eliminate the need for sedimentation.

Duration Commenced, April, 1971; Site Sarnia - applicable  
Continuing generally to the Great Lakes.

Commentary An in-house research project of the Pollution Control Branch, on the referral of the Project Operations and Sanitary Engineering Branches of the Ministry of the Environment. (Specific Budgetary Program - Pollution Control; Water Technology Section).

Budget \$18,000 salary, \$3,000 Capital (1972/73)  
continuing \$34,900 (74-75)  
\$10,000 (75-76)

Report Published, Journal of American Waterworks Association.

Supervision K. Roberts, Water Technology, Supervisor.

STUDY PLAN TO MONITOR PESTICIDE IRRIGATION FROM WASTE DISPOSAL SITES

Objective            To establish if the pesticides move with groundwater, and if so, how far and in what form.

                         If the results show positive movement in a form that may contaminate irrigation ponds and water streams, it may be necessary to institute a new method of disposal.

Description        The program will be conducted in three phases:

Phase I                Collecting samples from sites that are equipped with monitoring wells

Phase II                Installation of additional observation wells at one or two sites

Phase III                An expanded study to examine a broader range of pesticides and soil conditions

Duration             Phase I 5 Weeks

                         Phase II 9 Months

                         Phase III Depends on the data collected from phases I and II

Commentary        It will be a joint research project between the Ontario Ministry of the Environment, Pesticides Control Section, the University of Waterloo and the Provincial Pesticide Residue Testing Laboratory.

                         The University of Waterloo have asked the Pesticide Advisory Committee for funds.

... STUDY PLAN TO MONITOR PESTICIDE IRRIGATION FROM WASTE DISPOSAL SITES

Budget

Estimated costs for Phases I & II are \$4,015.00.

Estimated costs for Phase III will be determined upon the results of the previous two phases.

The Provincial Pesticide Residue Testing Laboratory will furnish all pesticide analysis at "no charge".

Report

One year

Supervision

Ontario Ministry of the Environment, Pesticides Control Section. Mr. F.A. Rovers and Dr. G.J. Farquhar of the University of Waterloo will serve as principle investigators for the study.

AUTOMOTIVE NOISE CRITERIA

<u>Objective</u>	<ol style="list-style-type: none"><li>1. To attempt to establish minimum muffler criteria required for proper automotive exhaust silencing.</li><li>2. To establish criteria for a possible stationary vehicle noise test for light vehicles.</li></ol>
<u>Description</u>	A Chrysler "slant 6" engine mounted to a dynamometer was fitted with a variety of mufflers recommended for the engine. For each muffler the engine was run through a multitude of R.P.M. and load conditions all of which were monitored for exhaust noise.
<u>Duration</u>	May 1974 - September 1974
<u>Commentary</u>	The study was funded through the Noise Pollution Control Section of M.O.E. Work was carried out under the auspices of Professor Z. Rief at the Institute of Industrial Research of the University of Windsor.
<u>Budget</u>	Approximately \$12,000
<u>Report</u>	Mid September 1974
<u>Supervision</u>	L.G. Kende , Head, Engineering & Analysis Unit.



GENERATION OF REALISTIC SEWAGE DESIGN FIGURES FOR NORTHERN ONTARIO

Objective        To utilize existing data to produce design figures for Northern Ontario where special conditions have created situations where actual sewage flow figures greatly exceed conventional design parameters.

Description     Data from Municipal and Provincial sewage treatment facilities will be assembled processed, then new design values will be established which reflect the effect of differences in physiology on the production of waste waters.

Duration        5 Months

Budget

Report           February 1, 1975

Supervision     G.W. Scott, District Officer

SWEEP PROJECT ON MER BLEUE BAYObjective

- 1) Prepare a summary of all scientific knowledge of the Mer Bleue ecosystem.
- 2) Conduct field studies to outline present condition of the bog and to locate areas of particular interest.
- 3) Survey the various interest groups concerned with development of the bog area.

Description

- 1) Literature search carried out.
- 2) Extensive field investigations were conducted. Of necessity, these were of a general nature becoming detailed only where special interest areas were detected.
- 3) A survey was carried out of government agencies, schools, universities, local residents, etc.

Duration

Three months

Commentary

Work done by University of Ottawa students under Dr. R.M. Reid, Assistant Professor, Department of Biology, University of Ottawa.

Budget

\$7,068.75

Report

September 10, 1974

Supervision

R.C. Burdett, Environmental Assessment

TAILINGS RECLAMATION (GOLD MINING) TOBURN SLIMES - KIRKLAND LAKE

Objective To render a slimes area which has been sterile for 30 years fertile through the use of aerobically digested sludge from the Municipal Sewage Treatment Plant.

Description After the physical parameters of the slimes area have been documented (partical size, chemical contaminants, nature of runoff and soil physiology) aerobically digested sludge will be spread and worked into the tailings material to permit seeding and the growth of desirable vegetation. Monitoring by Industrial and Municipal and Private staff of this Ministry will continue under the guidance of Technical Services staff while site maintenance will be done by Natural Resources.

Duration If results are impressive after a year, additional studies will be initiated for other slimes areas.

**Budget** No special funds have been requested to date.

Report                      October    1975

Supervision Ministry of the Environment - Jim Fry - Industrial  
-Wayne Scott - Municipal

ALTERNATIVES IN DISINFECTION OF WASTEWATER EFFLUENTS

Objective            1) To study the efficiency, advantages and disadvantages of chlorination, ozonation and chlorine dioxide in disinfection.  
                             2) To evaluate the toxicity of the effluents of the above treatments.  
                             3) To determine the effectiveness of the above treatments in upgrading the quality of secondary effluents.

Description

Duration            April, 1974 to June 1975

Commentary        This is a cooperative study, under the Canada/Ontario agreement between E P S, E M S and M O E and is being conducted at the MOE Ontario Research Facility at Brampton.

Budget             1974 - 75   Fiscal Year - \$27,000

Report             Upon Completion

Supervision        F.A. Tonelli, Wastewater Treatment Section  
                             Pollution Control Branch

UPGRADING OF LAGOON EFFLUENTS

Objective        To determine the effluent quality attainable by applying standard unit processes to the treatment of lagoon effluents.

Description     This study will investigate the use of micro - strainers, air flotation, chemical precipitation and filtration for algae removal from lagoon effluents.

Duration        September 1974 to December 1975

Commentary     This study is being funded under the Canada/Ontario Agreement.

Budget         1974 - 75 Fiscal year - \$29,000

Report          Upon completion of study

Supervision     J.W.G. Rupke, Wastewater Treatment Section.  
Pollution Control Branch

FEASIBILITY OF MOSQUITO ABATEMENT IN ONTARIO

Objective            Develop guidelines for municipality mosquito abatement programs, emphasizing larviciding as the primary control measure.

Description        Training and licensing of municipal personnel;  
Pre-treatment survey and sampling technical assistance;  
Treatment and data collection;  
Residue study and evaluation of efficacy.

Duration            Open-Ended    1974-Orillia        1975 (proposal) - Wallaceburg, North Bay,  
Nepean Twp., and Mara Twp.

Commentary        Project is conducted by the Pesticides Control Section, in co-operation with municipality personnel, University of Guelph, College of Biological Sciences, Dr. R. Wright, and the Provincial Pesticides Lab.

Budget              Not determined

Report              December '74 Initial report.

Supervision        D.L. MacKenzie, Pesticides Control Section

EVALUATION OF NEW AQUATIC HERBICIDES POTENTIALLY USEFUL IN ONTARIO

Objective Determine from efficacy data and field performance those compounds which may be potentially useful in the control of problematical aquatic vegetation.

Description Evaluation was undertaken of the following compounds in 1974:

- (a) Terbutryne (Swiss and U.K. granular and flowable formulations) for control of filamentous algae, Chara sp., submergent macrophytes including tapegrass;
- (b) Glyphosate for control of wild rice;
- (c) Diquat-paraquat mixtures for control of tapegrass.

Gramoxone S concentrate used as source of paraquat.

Duration Open-Ended

Commentary In-house program of the Pollution Control Branch in co-operation with chemical industries, Water Resources Branch, Ministry of the Environment and the Provincial Pesticides Lab, Guelph.

Budget Not determined

Report November '74 Summaries for Canada Weed Committee, Eastern Section no formal report.

Supervision Miss D.L. MacKenzie, Pesticides Control Section.

PARASITES IN SEWAGE SLUDGE

Objective To study the occurrence and survival of parasites, infective to man and domestic animals, found in sewage sludges applied to pastures as fertilizer.

Description The initial phase of the study will involve a literature search to assess the state of the art on occurrence, effect of treatment, fate and detection methodology for parasites; preparation of a report on above; design and conduction of study to quantify problem.

Duration 1974 - 1976

Commentary An in-house research project of the Pollution Control Branch funded through C/O A (Specific Budgetary Program - Pollution Control Water Technology Section).

Budget

1974 - 1975	\$4,000
1975 - 1976	\$11,000

Report Upon completion of each study phase

Supervision H. Graham, Water Technology



USE OF FLYASH IN WASTEWATER TREATMENT

Objective        To investigate the possible use of fly-ash in the treatment of wastewater related to its filtration and adsorption properties.

Description     This is a laboratory study using model plant processes investigating the use of various qualities of fly ash in reactor and column formats.

Duration        1974 - 1975

Commentary     An in-house project of Pollution Control Wastewater Treatment section.

Budget           1,500 man-hours       \$7,500 (1974-75)

Report           In preparation

Supervision     S.A. Black, Supervisor, Wastewater Treatment  
V. Hraseova

# Air Resources Branch

ATMOSPHERIC REACTIONS - PHOTOCHEMICAL SMOG

Objective To establish firmly what relationship exists between automobile emissions and photochemical smog, and to assess the contribution of other nitrogen oxide emissions sources. Standards for abatement of nitrogen oxides and reactive hydrocarbons should ultimately be formulated.

Description A theoretical and experimental investigation aimed at selecting a systematic rationale for laboratory experiments and for their extrapolation to atmospheric conditions. Study of appropriate control strategy for photochemical smog products by development of mathematical models of kinetics and of isoreactivity contour maps. Study of the production of sulphate aerosol with  $\text{SO}_2$  as precursor and hydrocarbons present.

Determination of the effect of automobiles on concentrations of  $\text{NO}_x$ , hydrocarbons, and oxidants in Metro Toronto. Development of techniques for individual hydrocarbons analysis in the atmosphere; study of aerosol formation conditions and size, and chemical composition spectra of atmospheric aerosols as formed. Study of the temperature coefficients of photochemical smog reactions.

Duration Commenced 1971/72; five year duration

Commentary A research grant to the University of Toronto, Dr. C.N. Phillips, funded by the Air Resources Branch, (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies).

<u>Budget</u>	\$20,000 (1971/72); \$30,000 (1972/73); \$26,000 (1973/74)
<u>Report</u>	<ol style="list-style-type: none"><li>(1) Oxidants in Toronto (Interim)</li><li>(2) An Analysis of the Oxidant Measurements in Toronto-Hamilton</li><li>(3) Dispersion and Photochemical Reactions of Air Pollutants in Toronto</li><li>(4) Various Factors Affecting Photochemical Smog</li><li>(5) Chemical Reactivity of Hydrocarbons in Smog Formation</li><li>(6) Estimation of Physiological Smog Symptom Potential from Chemical Reactivity of Hydrocarbons</li><li>(7) Estimation of Reactivities of Olefins in Smog Formation from Molecular Structure</li></ol>
<u>Supervision</u>	Dr. S. Stevens, Head, Special Studies Unit.

CATALYSIS IN AIR POLLUTION CONTROL

Objective To improve the technology for abatement of anticipated air pollution problems.

Description Experimentation with a corona-discharge reactor in the field, to assess its technical applicability to various odor emission sources, and its effectiveness on individual odor-causing substances (hydrogen sulfide, carbon and nitrogen compounds).

Duration Six years; to be completed 1973/74

Commentary A research grant to the University of Western Ontario, Dr. K.A. Shelstad, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies).

Budget \$6,000 (1973/74)

Report None as yet

Supervision Dr. S. Stevens, Head, Special Studies Unit

COLLECTION AND ANALYSIS OF POLYCHLOROBIPHENYLS (PCBs)  
IN THE ATMOSPHERE

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Objective To offset a perceived time lag between apprehension of latent air pollution problems, and development of technology and abatement strategies to cope with them.

Description Monitoring of background levels of PCBs in ambient air at select sites, coupled with stack sampling at suspected emission sites.

Organic constituents present in ambient air are trapped by solvent absorption, and identified by the gas chromatograph-mass spectrometer technique.

Quantitation of PCBs using gas chromatography-electron capture detection instrumentation.

Duration One year (1973/74)

Commentary A research grant to the Ontario Research Foundation, Dr. G.H.S. Thomas, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies).

Budget \$13,000

Report Anticipated, Spring 1974

Supervision Dr. S. Stevens, Head, Special Studies Unit

COMPARATIVE FIELD TESTING OF NITRATION PLATE TECHNIQUES

Objective        To facilitate firm assessment of the relationship between automotive emissions and photochemical smog, and the contribution of other nitrogen oxide emission sources.

Description     In order to determine the effects of meteorological conditions on plate sensitivity, sample exposure series will be conducted for one-month and one-week durations respectively, under actual atmospheric conditions. Responses will be compared to continuous instrumental measurements. Further laboratory studies will investigate certain aspects of the nitration plate techniques, viz. the effect of other pollutants, examination of response to peak concentrations during exposure. The most suitable method of calibrating nitration plate data will be determined.

Duration        One year (1973/74)

Commentary     A research grant to the Ontario Research Foundation, Dr. S.C. Barton, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources: Special studies).

Budget           \$4,900

Report           None as yet

Supervision     Dr. S. Stevens, Head, Special Studies Unit.

CONSTRUCTION OF MARK II H<sub>2</sub>SO<sub>4</sub> AEROSOL MONITOR

Objective            To develop a remote monitoring system which will respond instantly to contaminant emission; and to further classify the nature of contaminants and associated potential health hazards.

Description        To incorporate improvements and simplifications based on experience from field tests and re-evaluation of overall design, into Mark II model H<sub>2</sub>SO<sub>4</sub> Aerosol Monitor. Specifically, to reduce complexity of moving parts by converting individual operations into a continuous operation, and to improve the design of moving parts.

Duration            One year (1973/74)

Commentary        A research grant to the Ontario Research Foundation, Dr. H.G. McAdie, funded by Air Resources Branch (Specific Budgetary Program-Air and Land Pollution Control: Air Resources; Special Studies)

Budget              \$12,000

Report              None as yet

Supervision        Dr. S. Stevens, Head, Special Studies Unit.



CONSTRUCTION OF A MARK II REACTIVE HYDROCARBON MONITOR

Objective        To facilitate examination of the relationship existing between automotive emissions and photochemical smog, and of the contribution of other nitrogen oxide emission sources.

Description    Modification of the reactive hydrocarbon monitor, Beckman model 911 Photometer.

Duration        One year (1973/74)

Commentary     A research grant to the Ontario Research Foundation, Dr. S.C. Barton, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies).

Budget          \$13,900

Report          None as yet

Supervision    Dr. S. Stevens, Head, Special Studies Unit.

DISPERSION OF PARTICULATE POLLUTION FROM LOW ELEVATION SOURCES

Objective To develop and validate a model of low elevation sources of particulates such as coke ovens, large roof monitors, coal piles, etc. Model will be used to predict impact of low elevation sources on air quality, and to compare outcomes of alternative decisions on source control.

Description Starting with existing urban Air Quality simulation models to develop a model of the atmospheric dispersion of particulate matter with special emphasis on large, low elevation sources including coke ovens, coal piles, roof monitors and roof-level vents, autos, and others. Model will simulate air quality resulting from alternative decisions on the control of particulate emissions.

Duration May, 1973 to December, 1973 (Completed)

Commentary An in-house research project by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Air Quality and Meteorology).

Budget 10 man-days per month for professional staff (model project engineer, meteorologist).

Report Status reports have been issued, including "A Summary of Projects to Evaluate the Effectiveness of the Mathematical Model for Predicting Particulate Concentrations" July 20, 1973.

Supervision K. Trent, Project Engineer  
A.E. Boyer, P. Eng.

DISTRIBUTION OF AUTOMOBILE - GENERATED SUSPENDED PARTICULATES ADJACENT TO  
URBAN HIGHWAYS AND PREDICTION OF AUTOMOBILE - GENERATED POLLUTANT CONCENTRATIONS  
IN CITY STREET SUBCANYONS

---

Objective To explore the nature, size and composition of particulate matter as additional parameters for assessment of impact on human health and comfort.

Description Monitoring program using a Bausch & Lomb Model 40-1 Dust Collector and Anderson Hi-vol sampling heads.

<u>Duration</u>	Commenced 1972/73	<u>Site</u>	Location adjacent
	Completed 1973/74		to Highway 401

Commentary A research grant to the University of Waterloo, Dr. P.R. Slawson, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special studies).

Budget \$14,725 (1972/73); \$10,000 (1973/74)

Report Published in limited circulation technical publications; full report under project title.

Supervision Dr. S. Stevens, Head, Special Studies Unit.

EFFECTS OF AIR POLLUTION ON VEGETATION

Objective To screen resistant plant species, and determine desirable air quality criteria with respect to vegetation, complementing surveillance function.

Description

- (1) To assess the effects of airborne arsenic compounds on vegetation.
- (2) Development of clonal ramets sensitive and resistant to  $\text{SO}_2$  and fluorides.
- (3) To determine the protective effects of roadside dust on plants sensitive to atmospheric ozone and  $\text{SO}_2$ .
- (4) To determine the frequency of occurrence and the activities of saprophytic flora in a sulphur-polluted environment.
- (5) Testing of composted bark and animal manure for phytotoxicity (in collaboration with the University of Guelph).

Duration

- (1) Commenced 1972; completion indefinite
- (2) Commenced 1970; completion 1974
- (3) Commenced 1972; completion indefinite
- (4) Commenced 1972; completion 1974
- (5) Commenced 1972; completion 1973

Commentary      An in-house research project by the Air Resources Branch  
(Specific Budgetary Program - Air and Land Control: Air Resources; Special  
Studies).

Budget            \$20,000. salaries and capital expenditure, 1973/74.      Also  
applies to 1974/75

Report            Available for (5); reports will be prepared for (1), (3), and (4).

Supervision      Dr. S.N. Linzon, Chief, Phytotoxicology Section.

EMISSION CONTROL FROM GRAIN DRIERS

Objective To study design changes for grain driers, with or without positive dust control equipment, for the purpose of providing dust abatement techniques for the grain drying process which will satisfy Ontario Regulation #15 (Schedule 1, inert particulates).

Description Specifically, factors such as pre-cleaning, moisture removal per pass, and air flow during drying will be examined. Noise generation and variations in grain quality will also be considered. Dust collectors currently available will be evaluated, as well as innovative techniques.

Duration Two Years

Commentary A research grant to the University of Guelph, Dr. A. Meiering, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special studies).

Budget \$26,000 (1973/74)

Report None as yet

Supervision Dr. S. Stevens, Head, Special Studies Unit.

ENVIRONMENTAL CONTROL AND SAFETY ASPECTS OF FLARES

Objective            To perfect technology for abatement of anticipated air pollution problems.

Description        Development of reliable techniques for predicting the shape and length of flames over elevated flares at the design conditions for various major contingencies. Measurement of degree of complete combustion in a turbulent diffusion flame in a crosswind; measurement of NO<sub>x</sub> production in such a flame. Study of mechanism of smoke formation.  
Measurement of thermal radiation from turbulent diffusion flames in a cross-wind.

Duration            Commenced 1973/74; three year duration

Commentary        A research grant to the university of Waterloo, Dr. T.A. Brzustowski, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control; Air Resources; Special Studies).

Budget              \$5,000 (1973/74)

Report              None as yet

Supervision        Dr. S. Stevens, Head, Special Studies Unit

EXPLORATION OF COMPONENTS OF URBAN TORONTO "DUST" DOME

Objective        To supplement university grant research on urban "dust" domes with data on the nature and quality of contamination present in the atmosphere above urban Toronto.

Description    Ten flights in light aircraft equipped to measure occurrence of SO<sub>2</sub>, NO<sub>x</sub> particulate matter, etc., and to relate the contaminant density to meteorological factors.

Duration        Commencing Summer 1973; to continue through Spring 1974.

Commentary     A contract to private contractor by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies).

Budget          \$19,529

Report          None as yet; expected by Summer 1974

Supervision    Dr. S. Stevens, Head, Special Studies Unit.



FATE OF ATMOSPHERIC SULPHUR DIOXIDE AND ASSOCIATED SUBSTANCES SCAVENGED  
BY RAIN AND SNOW

---

Objective To assess acceptable rates of redeposition of smelter emissions by determining their long-term environmental effects. The study anticipates industrial pressure to extend deadlines for emission cutback orders.

Description Continue analysis, on a monthly basis, of a 30 + precipitation network for major ions, soluble and total metals, sulfates, etc., with location of three new stations south-west of Sudbury to assess derived transboundary material from the U.S.A. Analysis of stack and plume samples for S (32/34); analyses of stack samples for zeta potential of particulates, SEM and X-ray diffraction along with bulk chemical analysis. Study the metal-ligand association in precipitation. Sample four study lakes, four outlying lakes, on an event basis.

Duration Commenced 1972/73; five year duration.

Commentary A research grant to McMaster University, Dr. James R. Kramer. (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget \$20,000 (1972/73); \$31,620 (1973/74)

Report Fate of Atmospheric Sulfur Dioxide and Related Substances as Indicated by Chemistry and Precipitation (1972/73).

Supervision Dr. S. Stevens, Head, Special Studies Unit.

INFORMATION SEARCH - PROPERTIES, SOURCES AND ENVIRONMENTAL EFFECTS OF  
EXOTIC AIR POLLUTANTS

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Objective To offset a perceived time lag between apprehension of latent air pollution problems, and development of technology to cope with them.

Description A survey of some 2000 publications, providing data on the following exotic pollutants: Ammonia, Arsenic, Asbestos, Barium, Beryllium, Boron, Cadmium, Chromium, Copper, Fluorine, Hydrocarbons, Hydrochloric Acid, Hydrogen Sulfide, Iron, Lead, Manganese, Mercury, Nickel, Phosphorus, Selenium, Vanadium and Zinc.

Duration Commenced 1971/72; to be completed 1973/74

Commentary A research grant to the University of Windsor, D.H.W. Allan, funded by the Air Resources Branch. (Specific Budgetary Program - Air and Land Pollution Control: Air Resources Special Studies)

Budget \$2,445 (1973/74)

Report (1) A "KWIC" Index of Exotic Air Pollutant Literature, by A.W. Gnyp, Price, St. Pierre, Chongpison, Mozzon.  
(2) A Continuation and Extension of the Evaluation of Factors Affecting Stack Sampling (in two parts), by Gnyp, Price; publ I.R.I., U. of Windsor.  
(3) Final Report, Literature Survey - September, 1973

Supervision Dr. S. Stevens, Head, Special Studies Unit.

INVESTIGATION OF ACOUSTIC-AEROSOL PROCESSES

Objective        To perfect technology for abatement of anticipated air pollution problems; and in particular, to improve the technique of acoustic coagulation so as to reduce high operating and capital costs currently associated with conventional methods of generating sound.

Description     Research is being directed toward improved acoustic field design, and more efficient sound generation. Specifically, basic finite-amplitude acousto-aerosol mechanisms are being studied.

Duration        Commenced 1971/72; to be completed 1973/74.

Commentary     A research grant to the University of Toronto, Dr. D.S. Scott, funded by the Air Resources Branch. Industrial application is being conducted by Chubb Industries Ltd.; primary development is sub-contracted to the Ontario Research Foundation. (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget           \$5,000 (1973/74)

Report           Interim reports available

Supervision     Dr. S. Stevens, Head, Special Studies Unit.

LAKE SEDIMENT STUDIES - SUDBURY (REDEPOSITION OF AIRBORNE SMELTER EMISSIONS)

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Objective            To assess acceptable rates of redeposition of smelter emissions by determining their long-term environmental effects.

Description        Collection of data on the rate per volume and total rate of export of metals from three watersheds in the Sudbury region, as base data for developing techniques to permit determination of metals budget for lakes and/or watersheds. Determine the degree to which presence of a lake or a watercourse influences the concentration of metals lower in the watercourse, and the distribution of metal content among the major subunits of the lake ecosystem.

<u>Duration</u>	Commenced 1973/74	<u>Site</u>	Whitson, Nelson
	five year duration		Fairbanks Lakes

Commentary        A research grant to Laurentian University, Dr. J.P. Morris, funded by the Air Resources Branch. Where their programs are not totally integrated, the water Quality Branch and the Ministry of Natural Resources are all conducting tests towards similar objectives on the same lakes. (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget            \$10,000 (1973/74)

Report            None as yet

Supervision        Dr. S. Stevens, Head, Special Studies Unit.

LIDAR INVESTIGATION OF THE URBAN ATMOSPHERE

Objective To develop a remote monitoring system which will respond instantly to contaminant emission; and to further classify the nature of contaminants and associated potential health hazards.

Description The ruby laser lidar unit acquired and modified in the 1972/73 fiscal year will be employed as a mobile facility and will continue a remote monitoring program of atmospheric properties. Emphasis will be placed on lidar measurements of smoke plumes, and an intensive field study will focus on the INCO stack plume at Sudbury.

Duration Commenced 1972/73; to be completed 1973/74

Commentary A research grant to York University, Dr. A.I. Carswell, funded by the Air Resources Branch (Specific Budgetary Program-Air and Land Pollution Control: Air Resources Branch; Special Studies).

Budget \$10,000 (1972/73), \$15,000 (1973/74)

Report PhD thesis, R.W. McNeil, papers presented at scientific meetings; report to AMB, Spring 1973.

Supervision Dr. S. Stevens, Head, Special Studies Unit.

LIDAR STUDY OF POLLUTANTS AND AEROSOLS IN THE LONDON AREA

Objective To develop a remote monitoring system which will respond instantly to contaminant emission; and to further classify the nature of contaminants and associated potential health hazards, i.e. size distribution of suspended particulate matter; the respirable non-respirable factor in particulate measurement; presence of sulfuric acid aerosols; differentiation between gaseous and particulate fluorides.

Description Assemble a laser radar (lidar) with scanning optics at an elevated position overlooking the city of London, to observe Mie backscattering from particulates in the air. Record lidar signatures for the urban area in various weather systems, over a period of at least one year. Analyze these signatures for information on sources of airborne particulate, the particulate diffusion away from the source, the particulate concentration, and the effects of local weather on particulate diffusion.

Duration Commenced 1972/73; two year duration.

Commentary A research grant to the University of Western Ontario, Dr. D.R. Hay, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget \$15,000 (1972/73); \$16,000 (1973/74)

Report None as yet

Supervision Dr. S. Stevens, Head, Special Studies Unit.

ODOUR CONTROL IN ANAEROBIC SYSTEMS

Objective            To perfect technology for abatement of anticipated air pollution problems.

Description        Laboratory and field experiments will be conducted on whey, chicken manure, potato processing wastes and wastes from rendering plants, to determine the effectiveness of formalin, formalin-sulfur acid and formalin-formic acid treatments for eliminating air pollution problems associated with the disposal of wastes from anaerobic storage facilities. Tests will also determine whether chemical treatments have harmful effects on soil microbes.

Duration            One year (1973/74)

Commentary        A research grant to the University of Guelph, Dr. K.R. Stevenson, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget              \$12,820

Report              None as yet

Supervision        Dr. S. Stevens, Head, Special Studies Unit.

ODOUR PREVENTION IN LIVESTOCK ENTERPRISES

Objective        To perfect technology for abatement of anticipated air pollution problems.

Description     To develop an odour control system involving the application of synthetic and natural humic acids to the concentration of selected odour components produced by poultry and swine; and to implement a field study that will test the practicality of the proposed odour control system.

Duration        One year (1973/74)

Commentary     A research grant to the University of Guelph, Dr. R.R. Hacker, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget         \$12,205

Report         None as yet

Supervision     Dr. S. Stevens, Head, Special Studies Unit.



## STUDY OF THE CHANGES INDUCED IN SOILS OF THE SUDBURY REGION AS A RESULT OF AIRBORNE SO<sub>2</sub> EMISSIONS

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Objective To assess acceptable rates of redeposition of smelter emissions by determining their long term environmental effects. The study anticipates industrial pressure to extend deadlines for emission cutback orders now in force.

Description A comparative sampling program of soils from three representative site types will be conducted:

- (1) areas remote from any effects of smelter emission;
- (2) areas not yet affected by smelter emissions, but within predicted fallout pattern from "superstack" gas flues;
- (3) areas which have been subjected to smelter emissions continuously for a considerable length of time.

Parameters measured will include particle size distribution, pH cation exchange capacity, exchangeable cations, base saturation, organic matter content, total sulfur conductivity, chlorides, titrable acidity. In conjunction, a laboratory study will examine the weathering changes that would be induced under controlled leaching of solid using H<sub>2</sub>SO<sub>4</sub> and relating it to levels of SO<sub>2</sub> emission and precipitation.

Duration Commenced 1973/74; five year duration

Commentary A research grant to the University of Guelph, Dr. R.L. Thomas, funded by the Air Resources Branch. Water Quality Branch is doing related studies of water bodies in this region. (Specific Budgetary Program - Air and Land Pollution Control: Air Resources; Special Studies)

Budget \$10,000 (1973/74)

Report

None as yet

Supervision

Dr. S. Stevens, Head, Special Studies Unit.

TRACE ANALYSIS OF AIRBORNE PARTICULATE MATTER AND OTHER ENVIRONMENTAL CONTAMINANTS

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Objective To explore the nature, size and composition of particulate matter as additional parameters for assessment of impact on human health.

Description Interface of plasma chromatograph with gas chromatograph/mass spectrometer system; addition of a dedicated computer for data reduction. Development of rapid analytical methods for trace analysis of compounds found on airborne particulate matter.

Duration Commenced 1973/73; two year duration

Commentary A research grant to the University of Waterloo, Dr. F.W. Karasek, funded by the Air Resources Branch (Specific Budgetary Program - Air and Land Pollution Contro: Air Resources; Special Studies)

Report (1) K.M. Gilroy, "Trace Analysis of Complex Organic Mixtures by GC/MS Techniques", M. Sc. Thesis, University of Waterloo, Waterloo, Ontario, April/73.

(2) R.J. Smythe, "Application of High Resolution Gas Chromatography and Mass Spectrometry to the Analysis of Engine Exhaust Emissions", Ph.D. Thesis, University of Waterloo, Waterloo, Ontario, April, 1973.

(3) R.C. Lao, R.S. Thomas, H. Oja, and L. Dubois, Anal, Chem., 45, XXX, May 1973.

(4) F.W. Karasek, D.M. Kane, and O.S. Tatone, Anal. Anal. Chem., 45, XXX, May, 1973

Supervision Dr. S. Stevens, Head, Special Studies Unit.

TRANSLOCATION OF LEAD FROM CONTAMINATED SOIL INTO EDIBLE PLANTS

Objective (1) To determine if lead in contaminated soil can translocate into the edible parts of garden plants in sufficient quantities to interfere with normal plant growth or render the plant unsafe to eat.

(2) To determine the amount of lead taken up by plants from soil in the absence of any atmospheric lead contamination.

Description Radishes, lettuce, and beans were grown in a clean-air greenhouse in soil contaminated with lead from a secondary lead smelter. Rate of plant growth and yield of edible parts relative to control plants were recorded. Plants were partitioned into roots, stems, leaves and fruit and each plant part was analyzed for lead content.

Duration January, 1973 - December, 1974

Commentary The experiments were performed by P.J. Temple and M.L. Smith, Phytotoxicology Section, with analytical services of the Vegetation and Soils Laboratory, Laboratory Branch.

Budget 20 man-days

Report Spring, 1975

Supervisor Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch

LOCALIZATION AND MOVEMENT OF LEAD IN PLANT TISSUES

Objective        To trace the movement of lead through plants and to locate site of local accumulation.

Description     Seedlings of radish and corn were grown in nutrient solutions to which various concentrations of lead had been added. After harvesting and sectioning, the slides were stained with sodium rhodizonate, a dye specific for lead under suitable conditions. The time-course of lead uptake and movement was observed.

Duration        March, 1974 - July 1974

Commentary     The research was performed by S. Alexander and P.J. Temple, Phytotoxicology Section. It was part of a larger study on the physiology of lead in plants.

Budget         30 man-days

Report          Interim report prepared.

Supervision     Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch.

HISTOCHEMICAL DETECTION OF ZINC IN LIVING PLANT TISSUES

Objective        To distinguish zinc in plant tissues in the presence of other metals as a differential diagnostic technique.

Description     Corn and radish plants will be grown in solutions artificially supplied with known concentrations of lead or zinc. The chemical sodium rhodizonate will be used to differentiate the presence of zinc or lead, and determine the location of the metal in the plants following uptake from solution. Experimental variations will include different ages of plants, different concentrations of metals and staining chemical, varying the pH of the solution and adding interfering chemicals. The plant material will be sectioned and examined histochemically.

Duration        October 1974 - May 1975

Commentary     An in-house research project conducted by G. Tung and P.J. Temple; Phytotoxicology Section.

Budget         Two staff members, part time.

Report         Preliminary Report filed December 1974.

Supervision     Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch

HISTOLOGICAL STUDY OF FLUORIDE INJURY DEVELOPMENT IN LEAF TISSUES

Objective To observe, record, and preserve the development of fluoride injury symptoms on artificially fumigated leaf tissues and to histologically examine and determine the underlying cellular derangement process.

Description Several different plant species will be exposed to hydrogen fluoride in a controlled environment chamber until visible injury symptoms appear. The plants will be removed and allowed to grow until such time as no new symptoms appear. Histological samples will be collected throughout the exposure period and following exposure and will be preserved. Examination of the cellular derangement of the tissue will provide evidence pertaining to the gradual development of fluoride injury.

Duration February - May, 1974

Commentary This research was performed in-house by S. Alexander, Phytotoxicology Section.

Report Fall, 1974

Supervisor Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch

THE INTERACTION OF FLUORIDE AND BORON IN PLANTS

Objective To study the synergistic and/or antagonistic effects of fluoride and boron on the accumulation of fluoride in plants and on plant toxicity. This study was initiated to support observations made on vegetation injury in the vicinity of a fiberglass mill which was emitting both fluoride and boron as air pollutants.

Description Plants susceptible to fluoride injury were grown in a clean-air greenhouse in nutrient solutions to which known amounts of fluoride and/or boron were added. The plants were harvested, degree of injury noted, and the plants analyzed for fluoride and boron. Other plants were grown in nutrient solutions to which known amounts of boron had been added and then fumigated with fluorid in controlled-environment fumigation chambers. The effects of a fluoride fumigation with and without the presence of boron were observed.

Duration January, 1974 - May 1974

Commentary Research was performed by P.J. Temple and M.L. Smith, Phytotoxicology Section. Analytical services provided by Vegetation and Soils Laboratory, Laboratory Branch.

Budget 35 man-days

Report Fall, 1974

Supervisor Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch



EFFECTS OF PARTICULATE FLUORIDE ON VEGETATION

Objective To determine the effects of particulate fluorides emitted from steel mills, which are deposited on leaf surfaces, on the uptake and toxicity of fluoride in plants. If significant amounts of fluoride in particles can be shown to become soluble on foliage, this may account for some of the discrepancies between air quality data for fluorine in the vicinity of steel mills and the amount of fluoride in vegetation in the same area.

Description Electrostatic precipitator dust from a steel mill was collected and analyzed for total and soluble fluoride. Plants sensitive to fluoride were exposed to the dust in controlled environment fumigation chambers, while air monitoring equipment recorded levels of total and gaseous fluoride in the chambers. Plants were exposed at various levels of temperature, humidity, dust concentration, and amount of surface moisture on the leaf. After suitable exposure periods, the plants were harvested and divided into terminal and basal portions for fluoride analysis on washed and not-washed samples. A comparison between the amount of fluoride in air and the amount taken up and translocated by the plants will give an indication of the extent to which particulate fluoride can be absorbed by plants.

Duration January, 1974 - June, 1974

Commentary The research was performed by P.J. Temple and M.L. Smith, Phytotoxicology Section, Industrial Abatement, West Central Region, supplied the particulate method.

Budget Supplies and equipment: \$500.00

Report

Spring, 1975

Supervision

Dr. S.N. Linzon, Supervisor, Phytotoxicology Section,  
Air Resources Branch

INTERACTION BETWEEN PEACH CANKER DISEASE AND FLUORIDES

Objective            To determine the effects of elevated fluoride levels on the growth and development of the fungal incitants of the common peach canker disease.

Description        The initial phase of the study will involve sample collection in the vicinity of a known airborne fluoride source to ascertain the fluoride content of the peach bark. The response of the fungal material then will be evaluated in the laboratory and in the field inoculations into existing and potted trees in the vicinity of a fluoride source.

Duration            April 1, 1974 to April 1, 1976

Commentary        The research will be performed in-house by plant pathologists, D.S. Harper and S. Bisessar, Phytotoxicology Section. Cooperation agencies include Canada Agriculture - Vineland and the Ontario Ministry of Agriculture & Food, Vineland.

Report              1975 (interim) and 1976 (final)

Supervisor        Dr. S.N. Linzon, Supervisor  
Phytotoxicology Section, Air Resources Branch

SUDBURY SOIL BIOASSAY STUDIES

Objective To determine the physical and chemical properties of soils from the Sudbury area; to assess their effects on normal germination, root development, and long term survival of indigenous plant species; to determine the effect of the metals and/or the excess acidity on the normal nutrient balance of the soil; and to determine the degree and extent of heavy metal uptake from the soil by edible garden plant species.

Description These experiments are conducted utilizing soil collected from several locations in the vicinity of the Sudbury smelters. All growth studies are conducted utilizing either the clean-air greenhouse or artificially controlled environment chambers. Chemical analyses of the soil and plant tissues are conducted either within the Ministry or by the soil testing laboratory, University of Guelph.

Duration August, 1972 - 1975

Commentary Those studies are being conducted in-house jointly by R.G. Pearson, Phytotoxicology Section, Dr. D. Balsillie, Northeast Region, Sudbury. Special soil analyses were contracted to personnel from the Soil Testing Laboratory, University of Guelph.

Report 1975 (interim) 1976 (final)

Supervisor Dr. S.N. Linzon, Supervisor  
Phytotoxicology Section, Air Resources Branch

EFFECTS OF OZONE ON AGRONOMIC AND HORTICULTURAL CROPS OF ONTARIO

Objective To define existing and future ozone pollution as it relates to the growth and yield of specific Ontario grown crops. Field observations by Ministry personnel suggest ozone air pollution as a contributing factor in each crop area referred to below.

Description To evaluate through artificial exposures and field trials (1) the effects of  $O_3$  on several varieties of soybean, particularly those containing Harosoy germplasm, (2) the relationship between early defoliation of tomato and ambient oxidant levels and (3) the influence of exposure to low levels of  $O_3$  on subsequent exposures to acute dosages of the same pollutant and (4) possible yield reductions to sensitive Ontario crops by using open-topped filtered and unfiltered field chambers.

Duration

- 1) Starting date December, 1974
- 2) Starting date December, 1974
- 3) Preliminary exposures made in fall of 1973. Study to continue through Winter 74/75
- 4) Starting date June 1975

Commentary Research will be performed in-house by Dr. D.B. Drummond, G.N. Vasiloff, and A.W. Hill, Phytotoxicology Section.

Report Upon completion of each component of the study

Supervision Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch.

CULTIVAR RESPONSE OF TOMATO TO PEROXYACETYL NITRATE

Objective To confirm through artificial exposures to pure PAN (peroxyacetyl nitrate) the relative sensitivities of several cultivars of tomato. The cultivars of interest demonstrated a differential response to a suspected PAN exposure at the Simcoe Horticultural Research Station in 1973.

Description Exposure of several varieties of tomato to PAN will be accomplished through the cooperation of the Pennsylvania State University, the only facility on the eastern seaboard capable of generating and monitoring PAN. The results of these exposures will be compared with the varietal response resulting from a suspected PAN exposure under field conditions in SW Ontario.

Duration January 1974 - 1976.

Commentary The project will be a cooperative study with the Pennsylvania State University and the Ontario Ministry of Agriculture and Food. Research to be performed in-house by Dr. D.B. Drummond, G.N. Vasiloff, and A.W. Hill, Phytotoxicology Section, with some contribution from Penn. State University.

Supervision Dr. S.N. Linzon, Supervisor, Phytotoxicology Section, Air Resources Branch

## SYMPTOMATOLOGY AND SENSITIVITY OF WHITE ASH TO SULPHUR DIOXIDE OR OZONE AND COMBINATION OF THE TWO GASES

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Objective To determine the sensitivity of white ash to pollutants  $\text{SO}_2$  and  $\text{O}_3$  found in ambient air along the north shore of Lake Erie, This tree species is being used in this area to monitor the effects of industrialization presently occurring at Nanticoke, Ontario.

Description Populations of white ash derived from both seed and grafted scions will be exposed to  $\text{SO}_2$ ,  $\text{O}_3$  and  $\text{SO}_2 + \text{O}_3$  to determine the population sensitivity and symptom development. These data will be necessary as future field evaluations of white ash begin in the Nanticoke area.

Duration Fall, 1974 - 1977.

Commentary Research performed in-house by Dr. D.B. Drummond, G.N. Vasiloff and A.W. Hill, Phytotoxicology Section.

Supervision Dr. S.N. Linzon, Supervisor, Phytotoxicology Section,  
Air Resources Branch

EFFECT OF ANTICORROSION STEAM TREATMENT CHEMICALS ON VEGETATION

Objective            To evaluate the injurious effect to plants of the anticorrosion compounds used to treat steam utilized for humidification within the Phytotoxicology Section's Controlled Environment facilities.

Description        The use of live steam in growth chamber and greenhouse facilities resulted in the development of toxicity symptoms on bean. Growth chambers have been used to determine the causal agent. Studies will follow to determine the effect of steam on greenhouse soils as it is widely used to sterilized soils, both treated and untreated to evaluate possible effects to greenhouse crops.

Duration            January 1974 - 1976

Commentary        Research to be performed in-house by Dr. D.B. Drummond, G.N. Vasiloff, and A.W. Hill, Phytotoxicology Section.

Supervision        Dr. S. N. Linzon, Supervisor, Phytotoxicology Section,  
Air Resources Branch.



# Laboratory Services Branch

ANALYTICAL METHODOLOGY FOR DETECTION OF PESTICIDE RESIDUES,  
METABOLITES, DEGRADATION PRODUCTS

Objective To develop methods of analysis for biological control agents, their metabolites and degradation products, in order to supply analytical support for the Biology and other Ministry of the Environment Branches.

Description (1) Review and extend methodology for analysis of organochloride insecticides.  
(2) Develop analytical methodology for organophosphate insecticides and their metabolites and degradation products.  
(3) Review and further develop methodology for analysis of triazine herbicides.  
(4) Review and further develop methodology for the analysis of 2.4.D.-type herbicides.  
(5) Develop methodology for analysis of carbamate and tiocarbamate materials.  
(6) Continue development of methodology for analysis of individual biological control agents not in the above categories.

Duration Ongoing

Commentary An in-house research project of the Laboratory Branch. (Specific Budgetary Program - Laboratory Services: Organic Trace Contaminants Section).

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, G.A.V. Rees, Project Scientist.

IMPROVEMENT OF HEAVY PETROLEUM PRODUCT ANALYSIS

Objective To expand capabilities for heavy petroleum product analysis. To provide definitive analytical evidence for source identification of materials causing taste and odour problems, toxicity and esthetic pollution or requiring court action.

The following approaches will be used:

- (1) Gas chromatography using capillary, S.C.O.T. (support coated open tubular) columns, and specific detectors to provide a "sulphur finger printing".
- (2) Liquid chromatography for class fingerprints and additive identification.
- (3) Fluorometric identification techniques.
- (4) Identification of oils by trace metal detection and ratio measurements.

Duration

- (1) 1 to 2 months
- (2) 3 months
- (3) 1 month
- (4) 1 month

Commentary An in-house research project of the Laboratory Branch. (Specific Budgetary Program - Laboratory Services; Organic Trace Contaminants Section)

Budget \$33,900

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, D.T. Wang, AA. Nicholson, Project Scientists.

METHODOLOGY FOR THE ANALYSIS OF INDUSTRIAL CHLORINATED HYDROCARBON  
RESIDUES

Objective            To provide adequate analytical methods for Environmental studies and monitoring for these materials.

Description        (1) Further evaluation of PCB/pesticide separations  
                         (2) Method development for hexachlorobenzene (HCB) and hexachlorobutadiene (HCBd).  
                         (3) Method development for chlorinated terphenyls  
                         (4) Method development for chlorinated naphthalenes

Duration            (1) 1 month  
                         (2) 2 months  
                         (3) 1 to 2 months  
                         (4) 2 months

Commentary        An in-house research project of the Laboratory Branch. (Specific Budgetary Program - Laboratory Services Organic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, Dr. Otto Meresz, Manager, Organic Trace Contaminants Section. G.A.V. Rees, Project Scientist.

POLAROGRAPHIC ANALYSIS OF WATER SAMPLES TO MONITOR DETERGENT COMPONENTS,  
INCLUDING NTA

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Objective        To develop polarographic methodology for the analysis of water samples for determination of detergent components including NTA. To permit monitoring of these components and study of their behaviour as potential environmental hazards, such as mobilization of heavy metals from sediments.

Duration        Ongoing.

Commentary        An in-house research project of the Laboratory Branch. (Specific Budgetary Program - Laboratory Services: Organic Trace Contaminants Section).

Budget            \$6,000

Report            In preparation

Supervision        P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, D.T. Wang, Project Scientist.

## INVESTIGATION OF METHODS OF CONCENTRATING TRACE ORGANIC IMPURITIES IN WATER

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Objective To facilitate the analysis of organic micro-pollutants by means of preconcentration techniques. Organic micropollutants in water present a serious challenge to find means of separating and measuring. A means of preconcentration in the field, or in the laboratory, would be of considerable value.

Description Macroreticular resins as a means of concentration and multisolvent or pH separation will be evaluated. The study will establish optimum operating parameters for the techniques developed.

Duration Approximately three months.

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Organic Trace Contaminants Section).

Budget \$2,000

Report September 1975

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, W.K. Duholke, Project Scientist.

DETERMINATION OF NITRILOTRIACETIC ACID (NTA) BY GAS CHROMATOGRAPHY.

Objective To provide a method which can be used to check data obtained by polarography and to determine NTA at levels below the detection limit of polarographic procedures. In the presence of heavy metals polarography can give anomalous data hence the need for a referee method. In addition, gas chromatography can be utilized to the 2 ppb level while polarography has a detection limit of 50 ppb.

Description Concentration techniques will be applied to dilute aqueous solutions of NTA, followed by esterification and subsequent gas chromatographic analysis. The gas chromatographic and polarographic techniques will be compared.

Duration Three months

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services: Organic Trace Contaminants Section).

Budget \$7,000

Report March 1975

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson, Project Scientist.

DETERMINATION OF ELEMENTAL SULPHUR IN WATER AND SEDIMENTS BY GAS  
CHROMATOGRAPHY

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Objective To provide a rapid, sensitive method for the determination of free elemental sulphur in water and sediment samples at the ppm level. Elemental sulphur plays an important role in the aqueous environment. There is significant involvement in the immobilization and partial detoxification of heavy metals. Sulphur is commonly a factor in taste and odour problems.

Description Solvent extraction will be used to separate the sulphur followed by determination using gas chromatography.

Duration One month

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Organic Trace Contaminants Section).

Budget \$2,100

Report June 1975

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson, Project Scientist.



DETERMINATION OF CITRATES IN DETERGENTS AND SEWAGE TREATMENT PLANT  
EFFLUENTS BY GAS CHROMATOGRAPHY

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Objective        To develop a satisfactory analytical technique for the determination of citrates in detergents, sewage treatment plant effluents and storage lagoons. The use of citrates as detergent builders is becoming more prevalent since the partial ban on phosphates. Since the effect of such additives could be harmful, it is necessary that receiving waters be analyzed for them.

Description     Esterification of solutions of citric acid using propanol - acetyl chloride will be followed by gas chromatographic analysis.

Duration        One month

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Organic Trace Contaminants Section).

Budget           \$1,000

Report           January 1975

Supervision     P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson, Project Scientist.

EVALUATION OF ORGANIC MICROPOLLUTION IN THE LOWER GREAT LAKES AS  
MEASURED BY CARBON FILTER

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Objective To evaluate carbon filter results obtained from a number of Lower Great Lakes stations during the period 1966 to 1972. Organics, from natural and industrial sources, are adsorbed by activated charcoal and extracted by various solvents. The carbon chloroform extract (CCE) has been used as a water quality parameter and the CAE (carbon alcohol extract)/ CCE ratio has been recommended as an indication of the origin of the organics extracted.

Description The data will be examined for trends in CCE, CAE values and ratios dependent on local factors, seasonal variations etc. An attempt will be made to establish correlations with other general parameters for which data in this time period is available.

Duration 4 months

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Organic Trace Contaminants Section).

Budget \$8,000

Report July 1975

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson, Project Scientist.

DETERMINATION OF RESIN ACIDS AND FATTY ACIDS IN PULP MILL EFFLUENT

Objective To develop a fast, precise and accurate method for the determination of the above acids as a group, and possibly individually, in pulp mill effluent. Unsaturated fatty and resin acids are reported to be toxic to fish. In the past semiquantitative determination was achieved using a spot test method. Increased interest warrants development of adequate methodology.

Description Various methods will be examined and compared. Ether extraction followed by gas chromatographic analysis appears to be the most favourable.

Duration Four months

Commentary An in-house project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Organic Trace Contaminants Section).

Budget \$3,000

Report December 1974

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A. A. Nicholson, Project Scientist.

## DETERMINATION OF CHLORINATED SOLVENTS IN INDUSTRIAL EFFLUENTS

LS 11

Objective To determine light chlorinated hydrocarbons in the effluent streams of the organic chemical industry. Problems in industrial production of chlorinated hydrocarbons can lead to losses of these products into effluent streams. Recent concern over the long term effects of exposure to vinyl chloride has highlighted the need for effective methodology to detect and quantitate this class of solvents.

Description Extraction with various solvents will be examined to find an efficient means of separation. Gas chromatographic analysis will be used for quantitation. Initial concern will be directed towards vinyl chloride.

Duration Three months

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Organic Trace Contaminants Section).

Budget \$2,500

Report December 1974

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson; Project Scientist.

ANALYSIS OF INDUSTRIAL EFFLUENTS FOR MONO-AND POLY-AROMATIC  
HYDROCARBONS

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Objective        To develop methodology for the determination of mono- and poly-aromatic hydrocarbons in industrial effluents. Many of these compounds are carcinogenic and some industrial processes are suspected to be potential sources of aquatic pollution by these compounds. There have been requests to monitor treated effluents of petrochemical plants and steel mills for such compounds to gauge treatment efficiency.

Description      Gas and liquid chromatography will be examined as possible means of analysis.

Duration         Three months

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Organic Trace Contaminants Section).

Budget             \$5,000

Report             January 1975

Supervision        P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, Dr. A.A. Nicholson, Project Scientist.

MINESING SWAMP STUDY

Objective To determine inputs of pesticides, herbicides and fungicides to Minesing swamp from surrounding agricultural areas, by transporation in water courses.

Description Water samples will be taken at 10 sample points within the Minesing swamp during the summer of 1974. Samples will be analyzed for organochlorine, organophosphate, triazine and chlorophenoxy acid control agents.

Duration

Commentary An in-house project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Organic Trace Contaminants Section).

Budget \$1,500

Report December 1974

Supervision P.L. Diosady, Project Coordinator, Dr. O. Meresz, Manager, Organic Trace Contaminants Section, G.A.V. Rees, Project Scientist.

ANALYSIS FOR SELENIUM IN WATER, SEDIMENTS, AND BIOLOGICAL MATERIAL

Objective        To develop and evaluate methods of extreme sensitivity for selenium analysis in rocks, water and biological material.

Description     Levels in fish, geological variation and ratios of selenium to other metals will be studied.

Duration        Ongoing.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Report           Preliminary August 1973, Final August 1975.

Supervision     P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section.

ANION SAMPLE PRESERVATION

Objective            To establish more reliable means of stabilizing samples requiring analysis for sulphide and cyanide by studying various means of sample preservation.

Duration            Ongoing

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, Dr. B.R. Loesher, Project Scientist.

Budget               \$5,400.



APPLICATION OF ION SELECTIVE ELECTRODES TO DETERMINATION OF ANIONS  
IN WATER

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Objective            To evaluate the use of ion selective electrodes in analyses for: F, Br, Cl, CN, H<sub>2</sub>S and sulphite.

Duration            On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section, R.S. Sadana, Project Scientist.

CHEMICAL METHYLATION IN ST. CLAIR EFFLUENTS

Objective            To investigate the methylating capacity of industrial effluents.

Duration            On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Inorganic Trace Contaminants Section (Mercury Group)).

Report              See note

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section, W.K. Duholke, Project Scientist.

NOTE:    A number of reports have been written , but earlier work has raised many questions, therefore, work still ongoing.

Budget              \$5,000

CONFIRMATION OF ACCURACY OF GC IN DETECTING METHYL MERCURY DEVELOPMENT OF  
A PYROLYSIS LDC COMBINATION FOR RAPID METHYL MERCURY DETERMINATION

Objective        To confirm that the species measured as methyl mercury by GC is actually methyl mercury. To develop a fast organic mercury method using a pyrolysis preparation technique and determination by means of the LDC monitor.

Duration        Complete.

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program: Laboratory Services; Inorganic Trace Contaminants  
Section (mercury)).

Report            Completed.

Supervision      P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section.

DETERMINATION OF PPB LEVELS OF METALS BY ELECTRO-ANALYTICAL  
TECHNIQUES

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Objective        To develop methodology for metal analysis by polarography, pulse polarography, and anodic stripping voltammetry. These techniques will be applied to the determination of Cu, Ni, Zn, Pb, and Cd in water.

Duration        Ongoing.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section, R.S. Sadana, Project Scientist.

Budget            \$6,000.

DEVELOPMENT OF ANALYTICAL METHODOLOGY FOR TOTAL MERCURY IN BIOTA

Objective            To develop reliable means of analyzing insects and plants for mercury.

Description        Pyrolysis and FAAS will be investigated.

Duration            On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Mercury Group)).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section.

DETERMINATION OF PPB AND SUB PPB LEVELS OF METALS BY FLAMELESS AAS (FAAS)

Objective        To develop techniques for the efficient analysis of environmental samples for extremely low levels of metals using FAAS.

Duration        Commenced June 1974

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section, B.R. Loesher, Project Scientist.

Budget            \$4,500

DEVELOPMENT OF ANALYTICAL METHODS FOR TRACE METALS IN WATER

Objective        To provide methodology for reliable determination of Mo, Sn, Au, Bi, Sr, W, Sb, and Se in waters at ppb levels using fluorimetry, AAS and/or colorimetry.

Duration        On-going, will be at least a two-year project, continuing into 1975/76.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, B.R. Loescher, Project Scientist.

Budget            \$34,500

DEVELOPMENT OF FIELD AND LABORATORY TESTS AND COLLECTION TECHNIQUES FOR  
SULPHIDE ANALYSIS

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Objective            To investigate, for use in the field and the Laboratory tests such as molybdenum blue for sulphide, and draeger tubes for sulphite and sulphide.

Duration            On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager, ITC Section.  
F.C. Darcel, Project Scientist.



DEVELOPMENT OF IMPROVED LABORATORY TESTS FOR CYANIDE

Objective        To develop a rapid, sensitive method for the detection and at least semi-quantitative determination of free cyanide in water and waste water at sub ppm levels.

Duration        On-going.

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section)

Supervision        P.L. Diosady, Project Coordinator.  
                         J.N. Bishop, Section Manager.  
                         B.P. Neary, F.C. Darcel, Project Scientists.

Budget            \$6,000

DEVELOPMENT OF RELIABLE METHODS FOR THE DETERMINATION OF A VARIETY OF  
ANIONS IN WATER

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Objective To provide methods of analysis for halogens ( $I_2$ ,  $Br_2$ ,  $Cl_2$ ), total sulphur and cyanate at trace (ppm to ppb) levels.

Description Colorimetry, ion selective electrodes, and fluorometry will be studied.

Duration On-going.

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager ITC Section.  
F.C. Darcel, Project Scientist.

Budget \$2,100

EVALUATION OF CAPABILITY TO PRODUCE HEAVY METALS ANALYSIS IN FISH

Objective            To provide capability for analysis of Cu, Ni, Pb, Cd, Zn, Se, As, in fish.

Description        Digestion colorimetry, AAS, FAAS, and polarography paramenters will be used.

Duration            On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision        P.L. Diosady, Project Coordinator.  
                         J.N. Bishop, Manager, ITC Section.  
                         B.R. Loescher, Project Scientist.

Budget                \$5,000

EVALUATION OF A SOLVENT EXTRACTION/CONDUCTIMETRIC TECHNIQUE FOR THE  
DETERMINATION OF MOISTURE CONTENT OF SEDIMENT AND SOIL SAMPLES

Objective            To provide a rapid method for the determination of the moisture content of soil and sediment samples.

Duration            First stage ~~complet~~ed as of August, 1973.

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Report              Completed.

Supervision        P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager, ITC Section.

FATE OF ETHYL MERCURY IN SEDIMENTS

Objective        To determine by means of time-regulated sampling the fate of ethyl mercury in St. Clair Sediments.

Duration        On-going.

Commentary      An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Mercury Group)).

Supervision      P.L. Diosady, Project Coordinator.  
J.N. Bishop, ITC Section, Manager.  
B.P. Neary, Project Scientist.

IMPROVEMENT OF ANALYTICAL METHODOLOGY FOR MERCURY IN WATER, SEDIMENTS,  
FISH AND PLANT MATERIAL

---

Objective To develop more rapid, precise and sensitive methods of analysis of mercury in these media. A study of the effects of drying, seiving and screening for sediments; lyophilization, drying and a variety of digestion techniques for fish; and a number of oxidation reagents and amalgamation techniques for water analysis.

Duration On-going, August, 1973; requires at least twelve months.

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Mercury Group)).

Supervision P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager. ITC Section.

Budget \$28,000

METHODOLOGY FOR HEAVY METAL ANALYSIS IN PETROLEUM PRODUCTS

Objective        To provide methods of analysis and capacity to analyze for Ni, V, Cr, Mo in oils and Pb in gasoline.

Description     The conditions required in sample preparation (digestion, ashing, low temperature ashing) will be evaluated.

Duration        Ongoing.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section).

Supervision     P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section,  
B.R. Loesher, Project Scientist.

Budget           \$3,000

METHODOLOGY FOR HEAVY METALS ANALYSIS IN PLANT MATTER

Objective        To further develop methodology and provide capacity for reliable heavy metal analysis in plants.

Description     The study will relate to metals in corn, oats, barley, and other crops grown on sludge-treated land; to mosses and grasses used as cover on tailings areas; and to water plant analyses.

Duration        Ongoing

Commentary     An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section.

Report            To be prepared

Supervision     P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section,  
F.C. Darcel, Project Scientist.

Budget            \$6,000



METHODS FOR CONCENTRATING LOW LEVELS OF ANIONS TO LEVELS AMENABLE TO ANALYSIS

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Objective        To study methodology for extraction ion exchange, distillation and co-distillation techniques, for anions.

Duration        Ongoing.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants. Section).

Supervision     P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section,  
F.C. Darcel, Project Scientist.

METHODS OF CONCENTRATION OF HEAVY METALS IN WATER

Objective        To provide methodology for concentration of very low levels of metals found in municipal water supplies to ppm level.

Description     This will include; ion exchange, solvent extraction, anodic stripping, volatilization, distillation and co-distillation.

Duration        On-going, will require at least one year.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Inorganic)).

Supervision     P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section,  
B.R. Loescher, Project Scientist.

Budget           \$14,000



PRESERVATION AND ANALYSIS OF WATER SAMPLES FOR METHYL MERCURY AND FIELD  
METHODS FOR MERCURY IN WATER

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Objective            To provide an in-depth survey of mercury in water.

Description        Requires development of ion exchange, extraction or other preparative procedure for determination of methyl mercury in water. Requires improvement of sensitivity for total mercury and examination of published field methods. To determine the forms of mercury present in waters either of natural or industrial origin.

Duration            Requires eighteen months; projected completion 1974/75.

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Mercury)).

Supervision        P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager, ITC Section,  
B.P. Neary, Project Scientist.

Budget              \$12,000

RATIO OF METHYL/TOTAL MERCURY IN FISH AND DISTRIBUTION OF MERCURY  
THROUGHOUT FISH

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Objective        To statistically evaluate the relationship between methyl mercury and total mercury in fish from industrial and non-industrial areas; to investigate levels of Hg in various organs, to relate location to organ ratios or methyl mercury/total mercury ratio.

Duration        On-going.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Inorganic Trace Contaminants Section (Mercury)).

Report            In preparation

Supervision        P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager, ITC Section.

Budget            \$4,000

SULPHITE DETERMINATION AT LOW PPM LEVELS.

Objective        To develop an analytical procedure for the analysis of trace concentrations of sulphite.

Description     It has been found that sulphate can be quantitatively reduced to sulphite by activated zinc in the presence of hydrochloric acid. The hydrogen sulphide evolved produces a blue colour with acidified ammonium molybdate. This procedure will be evaluated on actual samples.

Duration        November 1974 to May 1975 (two weeks total time)

Commentary     In-house research project for Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget         Approximately \$1,000

Report         June 1975

Supervision     P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, F.C. Darcel, Project Scientist.

RELATIONSHIP BETWEEN SELENIUM AND MERCURY IN FRESHWATER FISH.

Objective To determine if there is any statistically significant correlation between the concentrations of selenium and mercury in fish. The effect of selenium and its compounds on the environment is a controversial subject. While high concentrations of selenium have demonstrably deleterious effects some authors claim selenium is beneficial. It has been reputed to counteract the detrimental effects of mercury.

Description Statistical evaluation of data for fresh water fish will be performed to determine if a correlation exists between selenium and mercury concentrations, species and size of fish, and geographical location.

Duration 1 month

Commentary In-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget \$1,000

Report January 1975

Supervision P.L. Diosady, Project Coordinator, J.N. Bishop, Manager, ITC Section, J.N. Bishop, Project Scientist.

HEAVY METALS IN FRESH WATER FISH RELATIONSHIP BETWEEN SPECIES, METALS  
AND LOCATION

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Objective Define metals concentrations in various tissue from various species of fish. A data base will, therefore, be available from which further experimentation may benefit.

Description Statistical Analysis of data generated prior to March 31, 1974.

Duration One week

Commentary In-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget \$500.

Report January 1975

Supervision P.L. Diosady, Project Coordinator,  
J.N. Bishop, Manager ITC Section,



THE DETERMINATION OF PART PER BILLION AND SUB PART PER BILLION  
LEVELS OF METALS BY FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY USING THE  
CARBON ROD ATOMIZER.

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Objective To develop techniques for the efficient analysis of environmental samples for extremely low levels of metals. Increased interest in the background levels of heavy metals has resulted in many studies requiring analysis at the ppb level. The carbon rod atomizer has proven to be a satisfactory means of analysis for lead at ppb levels. The technique should be usable for other metals.

Description Optimum operating parameters will be established for the common heavy metals. Standard curves will be developed, following which recoveries, precision and detection limits will be determined. Use of chemical "fixing" agents will be studied since these have been shown to be of value by other workers, in some cases.

Duration 2 - 3 months.

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget \$4,500

Report June 1975

Supervision P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, Dr. B.R. Loescher, Project Scientist.

ARSENIC DETERMINATION BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. (AAS)

Objective        To develop a method for arsenic which is simple, quick and reliable. Arsine generators for use with AAS have been developed by a number of manufacturers. The technique promises to be sensitive, quick and less prone to interference than the classical SDDC/pyridine colorimetric technique.

Description     An autosampler and proportioning pump serve as an arsine generator. The arsine is introduced into a heated quartz tube where the gas is converted to atomic arsenic which is then measured by atomic absorption.

Duration        One month

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget           \$3,000

Report           December 1974

Supervision     P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager ITC Section.  
Dr. B.R. Loescher, Project Scientist.

ANIONS: THE SEMIQUANTITATIVE DETERMINATION OF THE CHEMICAL SPECIES OF VARIOUS ANIONS

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Objective To develop thin layer chromatographic procedures for semi-quantitative analysis of anions to compliment spectrographic scan for metals. Identification of ionic species is of importance in assessing environmental impact.

Description Various stationary and mobile phases will be evaluated with respect to the RF values for the more common anions. Several developing reagents will also be evaluated.

Duration September 1974 - March 1975 (1 month Total time)

Commentary In-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget \$2,000

Report May 1975

Supervision P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager, ITC Section.  
F.C. Darcel, Project Scientist.

LABORATORY EVALUATION OF LEACHATES FROM SOLID WASTES

Objective        To develop a laboratory method for predicting the leaching characteristics and potential toxicity of solid wastes prior to disposal.

Description     The effect of leaching various types of solid waste with several leaching solutions under different experimental conditions on the release of toxic metals will be evaluated.

Duration         September 1974 - December 1975  
(actual duration - 1 month)

Commentary      In-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget            Approximately \$2,000

Report            September 1976

Supervision      P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager, ITC Section.  
F.C. Darcel, Project Scientist.

HEAVY METALS PROFILE IN SEDIMENT CORES FROM SELECTED SUDBURY LAKES

Objective To establish migration pattern of heavy metals in the sediment cores of selected Sudbury lakes. Analysis of fine sections of cores would provide information relating to the history of sedimentation, precipitation of metal upon reclamation and biological uptake of metals from the sediments into the lake water.

Description A literature search would be carried out. Sediment cores from the deepest end of the lakes would be frozen prior to their transportation to the laboratory for the analysis. Small Sections of these cores would be analysed for pH; dry weight and heavy metals by AAS.

Duration 4 months

Commentary In-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section). (Sudbury)).

Budget Approximately \$8,000

Report April 1975

Supervision P.L. Diosady, Project Coordinator.  
J.N. Bishop, Manager ITC Section.  
R.S. Sadana, Project Scientist.

DETERMINATION AND CHARACTERIZATION OF SULPHUR SPECIES IN SELECTED SUDBURY  
LAKES

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Objective To identify and determine various forms of sulphur in lake water and sediments. Low pH and high sulphate contents in Sudbury Lakes are associated with the atmospheric input of Sulphuric/Sulphurous acids. The mechanism of Sulphide/Sulphate formation is related to the sulphate oxidizing/reducing bacterial population. A knowledge of sulphur chemistry is essential in understanding the role of bacterial activity and the precipitation of metal sulphides.

Description Specially preserved Samples would be required for analysis of Sulphide and thiosalts. Mercaptans and organic disulphide will be pre-concentrated and determined by a G.L.C. method. Analytical methodology will be developed to determine various elemental sulphur species. A methodology will also be developed to determine total of all sulphur species.

Duration August 1974 - December 1974 (4 months)

Commentary In-house research project of the Laboratory Services Branch. (Specific budgetary Program; Laboratory Services; Inorganic Trace Contaminant Section (Sudbury))

Budget \$8,000

Report May 1975

Supervision P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, R.S. Sadana, Project Scientist.

STANDARDIZATION OF STOCK METAL SOLUTIONS BY CONTROLLED POTENTIAL COULOMETRY

Objective Standardization of metal stock solutions is essential to maintain high standards of quality control. These stock solutions are prepared in our laboratories and are used as reference standards for AAS, CRA and ASV analysis.

Description Suitable experimental conditions for each metal would be established by polarography - prior to their standarization by a coulometric procedure.

Duration February 1975 - on going

Commentary In-house project of the Laboratory Services Branch.  
(Specific budgetary Program; Laboratory Services; Inorganic Trace Contaminants Section).

Budget \$5,000

Supervision P.L. Diosady, Project Coordinator, J.N. Bishop, Manager ITC Section, R.S. Sadana, Project Scientist.

ANALYSIS OF DISSOLVED SOLIDS FOR ACCURACY AT LOW LEVELS

Objective        To determine if procedures can be adopted to give reliable results at low levels. Routine quality control results will also be used to define concentration ranges where data will be reliable.

Duration        Ongoing.

Commentary      An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section)

Report

Supervision      P.L. Diosady, Project Coordinator,  
Mr. S.P. Villard, Manager, Water Quality Section



ANALYTICAL QUALITY CONTROL OF THE GREAT LAKES PROGRAM

Objective            To coordinate quality control samples and analytical methods being used on Great Lakes Programs.

Duration            Ongoing

Commentary        An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section).

Supervision        P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
F.P. Dieken, Project Scientist.

Budget              \$3,000

EVALUATION OF COMMERCIAL FLUORIDE ELECTRODES

Objective        To evaluate commercial fluoride electrodes as alternatives to distillation.

Description     Equipment has not been reliable so far and other chemical methods are being considered as alternatives.

Duration        Commenced August 1974

Commentary      An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section).

Supervision     P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
M.W. Rawlings, Project Technician.

Budget           \$300

EVALUATION OF RESULTS OF LAKE DESTRATIFICATION

Description Four experiments are presently being carried out to evaluate effects on water quality and fish production, of the destratification technique.

Duration Field work will likely end in 1974.

Commentary An in-house research project of the Laboratory Services Branch. The Water Quality Section co-ordinates the work of several Ministry Sections, and that of the Ministry of Natural Resources. (Specific Budgetary Program - Laboratory Services; Water Quality Section).

Report Completed and reported.

Supervision P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.

MANGANESE ANALYSIS

Objective            To adapt the present iron digestion procedure to give manganese simultaneously on a separate automatic analyser channel.

Duration            Commenced September 1973.

Commentary        An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services Water Quality Section).

Supervision        P.L. Diosady, Project Coordinator.  
                         Mr. S.P. Villard, Manager, Water Quality Section.

Budget              \$5,000

METHODOLOGY FOR MEASUREMENT OF FREE CHLORINE

Objective            To search the literature and to test field methods for measuring free chlorine.

Duration            Literature search is completed, testing to be commenced in October, 1973.

Commentary        An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section)

Supervision        P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.

Budget              \$5,000

NORTHERN ONTARIO WATER RESOURCES STUDY

Objective            To carry out a water quality study of the major river basins draining into Hudson Bay.

Duration            Field work            completed during 1973/74.

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services Water Quality Section)

Report              Completed and Reported.

Supervision        P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.

PHOSPHORUS ANALYSIS IN SEDIMENTS

Objective            To develop a method for the fractionation of sediment phosphorus into discrete chemical forms.

Duration            Commenced January 1974

Commentary        An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section)

Supervision        P.L. Diosady, Project Coordinator.  
                         Mr. S.P. Villard, Manager, Water Quality Section.  
                         A. Hussain, Project Scientist.

Budget              \$15,000

RECREATIONAL LAKES STUDY - CHEMICAL WATER QUALITY

Objective        To prepare a report on chemical water quality of the lakes studied under this program.

Duration        Ongoing

Commentary      An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Water Quality Section; Microbiology Section)

Supervision      P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
C.E. Simpson, Project Scientist.

Budget           \$25,000



SILICA ANALYSIS

Objective            To review present method and to devise an automated procedure.

Duration            Commenced January 1974.

Commentary        An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section)

Supervision        P.L. Diosady, Project Coordinator.  
                         Mr. S.P. Villard, Manager, Water Quality Section.  
                         Dr. F.P. Dieken, Project Scientist.

Budget              \$7,000

SODIUM AND POTASSIUM ANALYSIS - ALTERNATIVE TO THE FLAME PHOTOMETER

Objective        To develop a more accurate alternative to the flame photometer, using the emission mode on an Atomic Absorption unit.

Duration        Commenced March 1974.

Commentary      An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section).

Supervision      P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality.  
S. Villard, Project Scientist.

Budget            \$3,000

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SUDBURY ACID MINE WASTE STUDY

Objective            To improve methods of analysis of pH and low level ionic components and to provide on-site analysis for the proposed reclamation studies.

Duration            Ongoing

Commentary        An in-house research project of the Laboratory Branch, complementary to the fullscale environmental assessment of this region by the Water Quality Branch. (Specific Budgetary Program; Laboratory Services; Water Quality Section)

Report              Preliminary (internal report)

Supervision        P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.

TOTAL CARBON

Objective        To evaluate the use of the total carbon analyser with a view to improvements and/or replacement.

Duration        Commenced - 1974

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section).

Supervision      P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
J.C. Hipfner, Project Scientist.

Budget            \$3,000

OUTLINE OF ANALYTICAL METHODS

Objective        To prepare a revised edition of analytical outlines for use by samplers.

Description     Analytical procedures used in the laboratory on a routine basis will be reviewed. The description will indicate sampling requirements and give analytical characteristics such as precision, detection limit, range of application and time required for analysis.

Duration        Ongoing.

Commentary     An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program: Laboratory Services; Water Quality Section).

Budget         \$8,000

Report         December 1974

Supervision     P.L. Diosady, Project Coordinator.  
S.P. Villard, Manager, Water Quality Section.  
J.M. Adamski, Project Scientist.

THE CORRELATION OF CERTAIN CHEMICAL PARAMETERS IN DOMESTIC WASTES.

Objective To establish the relationship, if any, between such time consuming tests as B.O.D., Kjeldahl nitrogen, total phosphorus, suspended solids etc, in domestic wastes. The ultimate aim would be to reduce the number of tests required to establish the quality of a domestic waste.

Description A statistical approach will be used in examining available data. If any correlations are found they will be examined carefully to determine the effect of local factors and to see if they can be utilized to simplify test requirements.

Duration 3 months.

Commentary An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Water Quality Section).

Budget \$6,000

Report Uncertain

Supervision P.L. Diosady, Project Coordinator.  
S.P. Villard, Manager, Water Quality Section.  
J.M. Adamski, Project Scientist.

THE AUTOMATED DETERMINATION OF FLUORIDE IN SURFACE WATERS, SEWAGE AND INDUSTRIAL EFFLUENTS.

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Objective        The currently employed manual technique is cumbersome and time consuming. An automated method would improve sample flowthrough time and reduce the cost of analysis.

Description     The Alizarin Blue colorimetric method has been employed successfully with manual techniques. Experimental conditions and statistical parameters will be developed for an automated procedure.

Duration        1 month

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Water Quality Section).

Budget           \$2,000

Report           March 1975

Supervision     P.L. Diosady, Project Coordinator.  
S.P. Villard, Manager, Water Quality Section.  
J.M. Adamski, Project Scientist.



MANUAL METHODS FOR ANALYSIS OF NITRATES, AMMONIA AND TOTAL  
KJELDAHL NITROGEN.

Objective        To develop manual methods for the analysis of nitrate, ammonia and total Kjeldahl nitrogen for use at the Kingston Laboratory. Simple, reliable, and accurate methods are needed that require a minimum of supporting equipment since the mobile laboratory has a limited amount of space available.

Description     Optimum experimental conditions will be established for the manual methods selected.

Nitrate: - Brucine method

Soluble Ammonia: - Phenol - Hypochlorite method.

Total Kjeldahl Nitrogen: - Phenol - Hypochlorite method.

Duration        3 months.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Water Quality Section).

Budget           \$5,000

Report           Completed.

Supervision     P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
Dr. F.P. Dieken, Project Scientist.

AN AUTOMATED METHOD FOR DETERMINATION OF PHENOLS IN WATER USING 4-AMINO-  
ANTI-PYRENE (4-AAP)

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Objective        To review the automated phenol method developed in the London Regional Laboratory, for use in the Toronto and Thunder Bay Laboratories.

Description     An attempt will be made to improve sensitivity and achieve lower detection limits. A comparison will be made with the Gibb's method. A literature search will be carried out to define the significance of the 4-AAP test.

Duration        Uncertain.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Water Quality Section).

Budget           \$2,000

Report           April 1975

Supervision     P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
Dr. F.P. Dieken, Project Scientist.

AN AUTOMATED METHOD FOR THE DETERMINATION OF LOW LEVEL CHLORIDES

Objective        To develop a sensitive method suitable for the analysis of Great Lakes waters, snow samples and other sources of trace level chloride concentrations.

Description     Optimum operating conditions will be established for an automated ferrithi ocyanate procedure.

Duration        3 months.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Water Quality Section; IJC Upper Great Lakes and Lower Great Lakes)

Budget           \$7,600

Report           Completed April 1974

Supervision     P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
Dr. F.P. Dieken, Project Scientist.

CRITICAL EVALUATION OF THE AUTOMATED TITRIMETRIC TECHNIQUE FOR ALKALINITY  
MEASUREMENT

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Objective To establish the true relationship between concentration and instrumental response. Experience with other instrumentation of similar character has indicated the need for this study to establish the validity of data generated by this method.

Description Standards and spiked samples will be used to obtain data which can be statistically evaluated to ensure the validity of the technique.

Duration Uncertain

Commentary An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Water Quality Section).

Budget \$600

Report Uncertain

Supervision P.L. Diosady, Project Coordinator.  
Mr. S.P. Villard, Manager, Water Quality Section.  
M.W. Rawlings, Project Technician.

IMPROVEMENT OF SUSPENDED SOLIDS ANALYSIS BY USE OF NON FIBROUS FILTERS.

Objective        Recent interest in developing figures for total solid material loadings into rivers from land drainage has emphasized the need to optimize the accuracy of analytical values for suspended solids. Improved precision and accuracy have been claimed by workers using nucleopore filters and a Cahn microbalance.

Description     Nucleopore filters and the Cahn microbalance will be used to generate statistical data. Synthetic samples will be analyzed in this manner and also using currently employed glass fibre filters and balances in order to determine the statistical relationship between the two techniques.

Duration        Uncertain

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Water Quality Section; IJC Land Drainage).

Budget           \$3,300

Report           March 1975

Supervision     P.L. Diosday, Project Coordinator, Mr. S.P. Villard, Manager, Water Quality Section, S. Villard, Project Scientist.

APPLICATION OF ANALYTAB SYSTEM OF CULTURE TESTING

Objective        To assess the feasibility of employing the Analytab system of culture testing as a means of improved identification bacterial isolates.

Duration        Expected termination date:    March, 1974    Completed

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision        L. Vlassoff, Manager, Microbiology Section.

ASSAY OF PSEUDOMONAS AERUGINOSA AND PSEUDOMONAS SP. AS PARAMETERS  
OF WATER QUALITY

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Objective        To make available as a standard parameter the assay for Pseudomonas aeruginosa and Pseudomonas sp. These organisms give information concerning the health quality of bathing waters and the nutrient condition of surface waters.

Duration        On-going.

Commentary      An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision      P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
C.A. Burger, Project Scientist.

Budget            \$500.

CHEMICAL AND BIOLOGICAL LAKE ANALYSES - SUDBURY ENVIRONMENTAL  
STUDY

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Objective        To determine what effects acid conditions are having on bacterial and fungal populations of Sudbury Lakes, and determine if acidic lakes have relatively more acid-tolerant micro-organisms compared with non-acidic waters. In view of the input of sulphur to these waters, the bacteria involved in the sulphur cycle are being studied to determine their role in sulphur recycling and generation of  $H_2SO_4$ .

Duration        Ongoing.

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision      P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology.  
F. Thompson, Project Scientist.

Budget            \$25,000



DETECTION AND ENUMERATION METHODOLOGY FOR SULPHATE-REDUCING BACTERIAL  
POPULATIONS

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Objective        To select a method and medium for easy and rapid detection and counting of populations of sulphate-reducing bacteria in water and sediment.

Duration        Expected termination date: November, 1973.

Commentary        An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision        P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
F. Thompson, Project Scientist.

Budget            \$2,000

DETECTION AND ENUMERATION OF PHOSPHATE-SOLUBILIZING BACTERIA

Objective        To ascertain the desirable rate of phosphorus recycling in lakes, considering that this rate should be governed to a large extent by the number and activities of organisms capable of releasing phosphorus.

Duration        On-going.

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision      P.L. Diosady, Project Coordinator.  
                     L. Vlassoff, Manager, Microbiology Section.  
                     E.A. Leggatt, Project Scientist.

Budget            \$1,000

EVALUATION OF THE PRESENCE OF ACINETOBACTER SP. AS A REFLECTION OF  
EUTROPHICATION OF LAKES

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Objective        To determine the usefulness of this bacteriological parameter as a reflection of eutrophication.

Description     Previous work carried out by E. Bennett and M. Jones of OWRC from 1968 to 1970 indicated that the population of Acinetobacter sp. in surface water reflected the trophic level. Assays for Acinetobacter on recreational lakes will be related to chemical and biological indicators.

Duration        Ongoing

Commentary     An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision     P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
C.A. Burger, Project Scientist

IDENTIFICATION AND CLASSIFICATION OF POLLUTION INDICATOR BACTERIA  
IN WATER DISTRIBUTION SYSTEMS

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Objective            To establish possible source(s) of pollution in the system.

Duration            Expected termination date:    December, 1975

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section)

Supervision        P.L. Diosady, Project Coordinator.  
                         L. Vlassoff, Manager, Microbiology Section.  
                         J.A. Clark, Project Scientist.

Budget                \$10,000

<u>Duration</u>	Expected termination date: December, 1975	<u>Site</u> Scotch Block, Halton County
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Commentary An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services: Microbiology Section).

Supervision P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.

MEDIA DEVELOPMENT FOR COLIFORM CONFIRMATION

Objective        Development of media for coliform confirmation and isolation of Clostridium perfringens used to detect fecal pollution.

Duration        Ongoing.

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision     P.L. Diosady, Project Coordinator.  
                     L. Vlassoff, Manager, Microbiology Section.  
                     J.A. Clark, Project Scientist.

MERCURY METHYLATION STUDIES OF ST. CLAIR SEDIMENT

Objective        To determine rate of methylation of inorganic mercury in sediments under various concentration of mercury and different nutrient levels; to develop a test which will indicate the relative potential for mercury methylation of a sediment; to isolate and identify micro-organisms capable of methylating mercury from St. Clair sediments.

Duration        Two parts completed. Final part expected completion  
March 1975.

Commentary      An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision      P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
D.M. Young, Project Scientist.

Budget            \$1,500

MICROBIAL ECOLOGY OF ACID MINE DRAINAGE WATER AND ASSOCIATED MILL  
TAILINGS WASTES

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Description      The generation of acidity and dissolution of iron and other heavy metals in mine-mill tailings wastes is in part accomplished by iron and sulphur-oxidizing bacteria. Population levels of these autotrophic bacteria in various mining wastes and identification of the microbial species capable of producing  $H_2SO_4$  from pyritic constituents of tailings will be surveyed. Effects of various mine-mill reagents on these species will be studied as well as other treatments in an attempt to inhibit their development on tailings wastes. Acids and heavy metals from the mining industry destroy most aquatic life and change species' development. A search for acid-tolerant or metal-tolerant micro-organisms in mine-polluted waters may be helpful in finding indicator species for this unique type of pollution.

Duration              On-going

Commentary          An in-house research project of the Laboratory Services  
Branch. (Specific Budgetary Program - Laboratory Services; Microbiology Section).

Supervision          P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
F. Thompson, Project Scientist



NITRIFICATION STUDIES

Description (1) Difficulties in waste water treatment at an Oakville Oil refinery are being encountered with high ammonia levels in effluent being a problem. Laboratory experiments with raw and treated waste water are being conducted in an attempt to overcome the suppression of nitrification by treatments which may be feasible to employ on the large scale, if successful on the small scale. (2) To determine the relationship between populations of nitrifying bacteria and ammonia oxidation, dissolved oxygen and BOD in Thames River surface water as it has been reported that in some instance where ammonia levels of river water are relatively high, BO sags may result from nitrification.

<u>Duration</u>	(1) Completion	<u>Site</u>	(1) Oakville
	anticipated, November 1973		(2) Thames River
	(2) Completion anticipated,		
	September 1973		

Commentary An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program - Laboratory Services; Microbiology Section)

Supervision Mr. P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
F. Thompson, Project Scientist.

Budget \$2,000

QUALITATIVE STUDY OF BACTERIAL POPULATIONS OF AN UNDEVELOPED LAKE AND A  
HEAVILY COTTAGED ONE

Objective                      To compare bacterial populations of a marsh and non-marsh area of an unpopulated lake and determine if there is a qualitative difference between these areas. To compare qualitatively, the bacterial population of a heavily cottaged lake to determine effects of any reclamation and cottage development on bacterial populations.

Duration                      Expected termination date: December, 1974

Commentary                      An in-house research project of the Laboratory Services Branch.

(Specific Budgetary Program: Laboratory Services; Microbiology Section.)

Supervision                      P. L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
C. A. Burger, W. F. Falby, Project Scientists.

Budget                              \$5,000

SEPTIC LEACHATE DETECTION

<u>Description</u>	Bacteriological procedures to detect septic tank leachate on recreational lakes with cottage development.
<u>Duration</u>	Ongoing function
<u>Commentary</u>	In-house applied research of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services: Microbiology Section)
<u>Supervision</u>	P. L. Diosady, Project Coordinator L. Vlassoff, Manager, Microbiology Section E. A. Leggatt, Project Scientist.

IMPROVED TECHNIQUES FOR THE ENUMERATION OF AUTOTROPHIC BACTERIA.

Objective        To develop improved techniques for enumeration of some autotrophic bacteria. The sulphur oxidizers tend to produce acid conditions, converting sulphur and sulphide to sulphate. They can be used as an indicator of industrial activity, particularly mining wastes. (sulphide ores etc.). For field use, a more convenient technique than the tube and MPN techniques, is required.

Description     A number of media will be used in comparing the spot plate and MF techniques to the 3 x 3 MPN procedure.

Duration        4 months

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Microbiology Section (Sudbury Study)).

Budget         \$3,600

Report         April 1975

Supervision     P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
D.M. Young, Project Scientist.

USE OF MPA MEDIA FOR PSEUDOMONAD COUNT

Objective        To establish acceptability of MPA media for pseudomonad count. The previously employed techniques which used a modified Drake's media or Pseudosel media have been shown to be non-specific and lacking in precision. These bacteria in recreational waters can cause general health problems. (eye, ear, nose and throat infections)

Description     A number of samples will be plated on MPA media and incubated. Many colonies will be tested to determine if positive colonies are in fact Pseudomonads and negative colonies are not.

Duration        4 month

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Microbiology Section).

Budget         \$4,600

Report         April 1975

Supervision     P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
D.M. Young, Project Scientist.

STANDARD PLATE COUNT DETERMINATION

Objective        To develop a reliable method for obtaining a Standard Plate Count. The previously employed Standard Plate Count used a black filter which has been shown to cause inhibition, making the method unreliable. Heterotrophic bacteria are part of the scenario in assessing the trophic level of a lake.

Description     A number of techniques will be tested on several general organic media using the same water sample. Difficulty, time required, and counts will be compared to determine the most suitable technique and media for both control and field laboratories.

Duration        4 months.

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Microbiology Section).

Budget         \$4,200

Report         April 1975

Supervision     P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
D.M. Young, Project Scientist.

SAMPLE STABILITY

Objective To determine if the use of different sterile sampling devices yields the same bacteriological counts for presently determined parameters. Sampling is a critical part of any analytical function. There are indications that rubber and certain plastics could be inhibitory or toxic to certain microorganisms. It is highly desirable that a sample container is constructed of a material which has no deleterious effects on the microorganisms being studied.

Description Water samples from a homogeneous source will be collected in glass bottles, polycarbonate bottles and rubber bulbs. The samples will be stored in the refrigerator and analysed for a number of parameters at fixed time intervals up to 24 hrs. after sampling.

Duration 3 months

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Microbiology Section).

Budget \$2,300

Report March 1975

Supervision P.L. Diosady, Project Coordinator .  
L. Vlassoff, Manager, Microbiology Section.  
D.M. Young, Project Scientist.

ACTINOMYCETES IN WATER

- Objective (a) To develop an enumeration technique for actinomycetes in water.  
(b) To relate actinomycetes concentration in water to land runoff. It is hoped that enumeration of actinomycetes in water will give an indication of soil leachate, especially in agricultural areas. This would be helpful in establishing the amount of material brought into rivers by rainfall and runoff.
- Description (a) Literature search  
(b) Experimentation with various media to find the most suitable for this purpose.  
(c) Collection of data in agricultural land drainage areas in dry and wet weather.
- Duration 6 months.
- Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Microbiology Section).
- Budget \$2,900
- Report May 1975
- Supervision P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
E.A. Leggatt, Project Scientist.



MICROBIOLOGICAL CRITERIA FOR BEACH MANAGEMENT

Objective To establish beach management guidelines. Overcrowded beaches may constitute a health hazard. The Ministry of Natural Resources wishes to establish guidelines for beach management based on the relationship between the level of indicator organisms in the water and the numbers of people using the beach.

Description Two four day surveys will be undertaken on two separate occasions on two separate beaches over Friday, Saturday, Sunday and Monday. Samples will be taken at fixed times on each of these days in order to determine the increase in microbial concentrations with numbers of people.

Duration 3 months

Commentary An in-house project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Microbiology Section)

Budget \$4,200

Report March 1975

Supervision P.L. Diosady, Project Coordinator.  
L. Vlassoff, Manager, Microbiology Section.  
E.A. Leggatt, Project Scientist.

DETERMINATION OF FREE CARBON IN AIR PARTICULATE

<u>Objective</u>	To assay the free carbon content of Ontario atmosphere. (As a nuisance factor, carbon fall-out generates frequent public complaint; as an adsorbent carrier of various gases and compounds, it presents potential dangers to health.)
<u>Description</u>	Part I: Development of analytical techniques for monitoring carbon content. Part II: Survey of free carbon in Ontario urban atmosphere. Part III: Determination of particle size distribution of atmospheric free carbon.
<u>Duration</u>	Part I: May 1973 to December 1973 Part II: Open-ended Part III: 1 year (April 1973 to April 1974)
<u>Commentary</u>	An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Air Quality Laboratory Section; Physical Methods).
<u>Budget</u>	\$11,500 (Salaries) \$8,000 (capital)
<u>Report</u>	Final report anticipated in March, 1974
<u>Supervision</u>	P. L. Diosady, Project Coordinator A. C. Rayner, Air Quality Laboratory Section Manager. Dr. J. A. Pimenta, Project Scientist.

INVESTIGATION OF THE OCCURRENCE AND DISTRIBUTION OF  
POLYNUCLEAR AROMATIC HYDROCARBON COMPOUNDS, ESPECIALLY BENZO (a) PYRENE,  
IN AIR

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<u>Objective</u>	To conduct pilot monitoring programs for polynuclear aromatic hydrocarbons in the field, relating levels of concentration to meteorological, topographical factors, preparatory to selecting Stations for routine analysis.
<u>Description</u>	Part I      Monitoring concentration levels of identified compounds in eleven Ontario communities by fluorometric measurement. Part II     Isolating and identifying other polynuclear hydrocarbons in urban air, with concurrent investigation of methodology for analyzing occurrence of these compounds in High-Volume filter extracts.
<u>Duration</u>	Part I      Begin of study - July, 1971; completion expected March 1975 Part II     Begin of study - December 1972; Open-ended
<u>Commentary</u>	An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services; Air Quality Laboratory Section, Organic Chemistry)
<u>Budget</u>	\$14,500 (salaries), \$13,000 (capital)
<u>Report</u>	A 60 page Interim Report issued December, 1971. A Paper presented at the National Conference of the

LS 90 (a)

American Chemical Society in New York, September, 1972.  
The First Annual Report                      issued in September, 1973.

Supervision

E. G. Adamek, Project Scientist.

A. C. Rayner, Manager, Air Quality Laboratory Section.

Dr. J. A. Pimenta, Project Scientist.

X-RAY FLUORESCENCE IN VEGETATION ANALYSIS

<u>Objective</u>	To determine which elements can be analyzed by the X-Ray fluorescence method.
<u>Description</u>	Part I     Analysis of sulphur, chlorine, phosphorus Part II    Analysis of lead, bromine, arsenic, silicon, etc.
<u>Duration</u>	Part I     April 1972 to March 1973 Part II    April 1973 to March 1974
<u>Commentary</u>	An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program - Laboratory Services: Air Quality Laboratory Section;
<u>Budget</u>	\$9,000 (salaries); \$7,000 (capital)
<u>Report</u>	Part I     Completed July 1973. Report in preparation Part II    Interim Report in preparation
<u>Supervision</u>	P. L. Diosady, Project Coordinator A. C. Rayner, Manager, Air Quality Laboratory Section Dr. J. A. Pimenta, Project Scientist

SULPHATION METHOD COMPARISON STUDY

Objective To establish the most reliable, accurate and rapid method for determining the sulphate ion concentration formed by the oxidation of sulphur dioxide by lead peroxide. A joint survey carried out by Ontario Hydro and the Air Quality Laboratory showed discrepancies between gravimetric analysis and automated colorimetric techniques.

Description Various methods will be used to analyse "simulated" lead candles and plates. The results will be compared.

Duration October 1975 to July 1975

Commentary An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Air Quality Laboratory Section).

Budget Total \$10,600

Report July 1975

Supervision P.L. Diosady, Project Coordinator.  
A.C. Rayner, Manager, Air Quality Laboratory Section.  
P.N. Vijan, Project Scientist.

VINYL CHLORIDE - ANALYTICAL METHODS DEVELOPMENT

Objective        To establish reliable and efficient methods for determining vinyl chloride in air, water and biological samples and to study problems in sampling and analysis of this compound. The carcinogenic properties of vinyl chloride have been recognized only recently. A number of agencies are working on methodology for the determination of vinyl chloride.

Description     The methods used by other agencies will be evaluated and modified if necessary to meet our requirements.

Duration        One year. (September 1974 to September 1975).

Commentary     An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program; Laboratory Services; Air Quality Laboratory Section).

Budget           \$19,400    Total

Report           September 1975

Supervision     P.L. Diosady, Project Coordinator.  
A.C. Rayner, Manager, Air Quality Laboratory Section.  
Dr. E.G. Adamek, Project Scientist.

SULPHATION CANDLE COMPARISON STUDY

Objective To compare methods of candle preparation, exposure and analysis carried out by the participating Laboratories. Concern was expressed at the difference in results from the lead peroxide candle surveys conducted by the Air Management Branch and Ontario Hydro.

Description (1) Compare the NASN (U.S.) Shelter used by Air Management Branch and the British Standard used by Ontario Hydro.  
(2) Compare the analytical methods used by the two Laboratories.  
(3) Compare candle preparation and exposure.

Duration 2½ years. (July 1972 - December 1974)

Commentary A cooperative effort between the Air Quality Laboratory Section of the Laboratory Services Branch and the Ontario Hydro. (Specific Budgetary Program; Laboratory Services; Air Quality Laboratory Section).

Budget \$4,160 Total

Report December 1974

Supervision P.L. Diosady, Project Coordinator.  
A.C. Rayner, Manager, Air Quality Laboratory Section.  
Dr. A.B. Foster, Project Scientist.



HI - VOL FILTER WEIGHT COMPARISON STUDY

Objective        To compare and contrast methodologies employed by the Air Quality Laboratory and the Ontario Research Foundation for the preparation, exposure and subsequent analysis of Hi-Vol filters. Anomalous results obtained for one station during the period January - July 1973 require clarification.

Description     Sampling units will be calibrated by both groups. Groups of filters will be cross checked by each group and the data compared.

Duration        1 year. (February - December 1974)

Commentary     A joint project between the Air Quality Laboratory and the Ontario Research Foundation. (Specific Budgetary Program, Laboratory Services Branch; Air Quality Laboratory Section).

Budget         \$2,130 Total

Report         December 1974

Supervision     P.L. Diosady, Project Coordinator.  
A.C. Rayner, Manager, Air Quality Laboratory Section.  
Dr. A.B. Foster, Project Scientist.

AN AUTOMATED METHOD OF MEASURING ARSENIC IN (a) HI-VOL AIR FILTERS  
(b) VEGETATION AND SOILS

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<u>Objective</u>	To develop a high speed, sensitive and precise method for measuring arsenic in air, soil and vegetation. Previously employed methods were based on measuring the coloured species formed when arsine reacts with silver diethyl-dithiocarbamate. Measuring the arsenic in arsine directly by atomic absorption would reduce the number of steps involved and would also be less prone to interference.
<u>Description</u>	Optimum instrumental conditions will be established and statistical parameters will be developed.
<u>Duration</u>	Part (a) completed Part (b) to December 1974
<u>Commentary</u>	An in-house project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Air Quality Laboratory Section)
<u>Budget</u>	Total \$39,700
<u>Report</u>	Part (a) reported Part (b) December 1974
<u>Supervision</u>	P. L. Diosady, Project Coordinator A. C. Rayner, Manager, Air Quality Laboratory Section P. N. Vijan, Project Scientist

AN AUTOMATED DETERMINATION OF SUBMICROGRAM AMOUNTS OF SELENIUM IN VEGETATION  
BY FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY. (F.A.A.S.)

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<u>Objective</u>	To develop a simpler; faster and accurate method for measuring selenium in vegetation. The fluorimetric method for selenium is very accurate, but difficult to use. The automated FAAS technique will be much simpler.
<u>Description</u>	Experimental conditions will be optimized and statistical parameters established. The automated procedure will be compared against the fluorimetric technique.
<u>Duration</u>	1 year
<u>Commentary</u>	An in-house research project of the Laboratory Services Branch. (Specific Budgetary Program: Laboratory Services; Air Quality Laboratory Section)
<u>Budget</u>	Total \$37,600
<u>Report</u>	January 1975
<u>Supervision</u>	P. L. Diosady, Project Coordinator A. C. Rayner, Manager, Air Quality Laboratory Section P. N. Vijan, Project Scientist

METALS IN ONTARIO AIR

Objective            To establish concentrations of metals in air.

Description        Suspended particulate matter in air is trapped on hi-vol glass fibre filters. Portions of the filters are extracted and metal contents determined by atomic absorption spectrophotometry. The metals measured are Cu, Ni, Zn, Mn, Cr, V, Fe, Cd, Pb.

Duration            Late 1970 to January 1975.

Commentary        An in-house research project of the Laboratory Services Branch.  
(Specific Budgetary Program; Laboratory Services; Air Quality Laboratory Section).

Budget              \$202,000 Total

Report              January 1975

Supervision        P.L. Diosady, Project Coordinator.  
A.C. Rayner, Manager, Air Quality Laboratory Section.  
P.N. Vijan, Project Scientist.

# **I N D E X**

## ADMINISTRATION PROGRAMS, development of

- derelict motor vehicle removal PC 10
- newsprint segregation, at-source PC 8
- pesticide control, cutworms on mineral soil PC 36
- private sewage disposal systems, guideline development for location PC 4
- pulp and paper industry, alternative policies for pollution abatement in EA 1
- reclamation of waste, experimental plant for PC 12
- solid waste disposal, region-centred planning studies PC 20

## AGRICULTURE, application of wastes to land

- sewage effluent as irrigation method PC 61
- sewage sludge, to agricultural land PC 62, PC 70
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\_\_\_\_\_, emission control

- anaerobic systems, odour control AR 20
- grain driers, design alterations for dust control AR 12
- livestock enterprises, odour control AR 21

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\_\_\_\_\_, pesticides see PESTICIDES, crop application

## AIR, abatement of pollution

- acoustic-aerosol coagulation, technique improvement AR 16
- catalysis (corona-discharge reactor) for H<sub>2</sub>S, carbon & nitrogen compounds AR 3

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